Marconi

2383

Service

volume 2

MP-83421

MP MASTER
MA31122

PS
THIS SIDE
10 SHEETS

# SPECTRUM ANALYZER
# 100 Hz – 4.2 GHz RF UNIT

2383

Code No. 52383-900G

## AMENDMENT RECORD

The following amendments are incorporated in this manual.

| Amendment No. | Date | Issued at Serial number prefix |
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8 Modifications and supplements

These chapters are contained in Vol. 1: Operating Manual

## HAZARD WARNING SYMBOLS

The following symbols appear on the equipment:

| Symbol | Type of hazard | Reference |
|---|---|---|
| ⚠ | Static sensitive device | Page (iv) |
| ⚠ | Dangerous voltages present | Page (iii) |
| ⚠ | Supply voltage | Page (iii) |

Note ...

Each page bears the date of the original issue or the code number and date of the latest amendment (Am. 1, Am. 2 etc.). New or amended material of technical importance introduced by the latest amendment is indicated by triangles positioned thus ▶ .... ◀ to show the extent of the change. When a chapter is reissued the triangles do not appear.

Any changes subsequent to the latest amendment state of the manual are included on inserted sheets coded C1, C2 etc.

# NOTES AND CAUTIONS

## ELECTRICAL SAFETY PRECAUTIONS

This equipment is protected in accordance with IEC Safety Class 1. It has been designed and tested according to IEC Publication 348, ´Safety Requirements for Electronic Measuring Apparatus´, and has been supplied in a safe condition. The following precautions must be observed by the user to ensure safe operation and to retain the equipment in a safe condition.

### Defects and abnormal stresses

Whenever it is likely that protection has been impaired, for example as a result of damage caused by severe conditions of transport or storage, the equipment shall be made inoperative and be secured against any unintended operation.

### Removal of covers ⚠

Removal of the covers is likely to expose live parts although reasonable precautions have been taken in the design of the equipment to shield such parts. The equipment shall be disconnected from the supply before carrying out any adjustment, replacement or maintenance and repair during which the equipment shall be opened. If any adjustment, maintenance or repair under voltage is inevitable it shall only be carried out by a skilled person who is aware of the hazard involved.

Note that capacitors inside the equipment may still be charged when the equipment has been disconnected from the supply. Before carrying out any work inside the equipment, capacitors connected to high voltage points should be allowed to discharge through the bleed resistors fitted for the purpose; do not attempt to remove the safety covers from the power supply until the lamp under the top cover stops blinking. Should the unit be reconnected to the supply with the safety covers removed then disconnected, do not attempt to discharge the power supply unit´s main reservoir capacitors using a shorting link as the equipment may be damaged. Discharge should always be allowed to occur gradually.

Note also that the 12 kV e.h.t. circuit for the cathode ray tube retains its charge for a considerable time after switch off. Therefore before any handling is carried out in the vicinity of the cathode ray tube or e.h.t. unit it is essential that the supply is disconnected from the instrument and the final anode lead is shorted to the chassis several times immediately after unplugging. The residual charge on the c.r.t. itself must also be removed by shorting the anode connection to ground.

### AC supply plug ⚠

The supply plug shall only be inserted in a socket outlet provided with a protective ground contact. The protective action shall not be negated by the use of an extension lead without protective conductor. Any interruption of the protective conductor inside or outside the equipment is likely to make the equipment dangerous.

## Fuses - primary and secondary

Note that there is a supply fuse in both the line and neutral wires of the supply lead. If only one of these fuses should rupture, certain parts of the equipment could remain at supply potential.

To provide protection against breakdown of the supply lead, its connectors, and filter where fitted, an external supply fuse (e.g. fitted in the connecting plug) should be used in the line lead. The fuse should have a continuous rating not exceeding 6 A.

Make sure that only fuses with the required rated current and of the specified type are used for replacement. The use of mended fuses and the short-circuiting of fuse holders shall be avoided. A number of secondary fuses are fitted to boards in the upper and lower units. For details of both primary and secondary fuses, refer to 'Performance Data' in the Operating Manual.

**CAUTION : STATIC SENSITIVE COMPONENTS**

Components identified with the symbol ⚠ on the circuit diagrams and/or parts lists are static sensitive devices. The presence of such devices is also indicated in the equipment by orange disks, flags or labels bearing the same symbol. Certain handling precautions must be observed to prevent these components being permanently damaged by static charges or fast surges.

(1) If a printed board containing static sensitive components (as indicated by a warning disk or flag) is removed, it must be temporarily stored in a conductive plastic bag.

(2) If a static sensitive component is to be removed or replaced the following anti-static equipment must be used.

A work bench with a grounded conductive surface.

Metallic tools grounded either permanently or by repeated discharges.

A low-voltage grounded soldering iron.

A grounded wrist strap and a conductive grounded seat cover for the operator, whose outer clothing must not be of man-made fibre.

(3) As a general precaution, avoid touching the leads of a static sensitive component. When handling a new one, leave it in its conducting mount until it is required for use.

(4) If using a freezer aerosol in fault finding, take care not to spray programmable ICs as this may affect their contents.

**WARNING : HANDLING HAZARDS**

This equipment is formed from metal pressings and although every endeavour has been made to remove sharp points and edges care should be taken, particularly when servicing the equipment, to avoid minor cuts.

Cathode ray tube. When exposing or handling the tube take care to prevent implosion and possible scattering of glass fragments. Handling should only be carried out by experienced personnel and the use of a safety mask and gloves is recommended. A defective tube should be disposed of in a safe manner by an authorized waste contractor.

**WARNING : TOXIC HAZARD**

Many of the electronic components used in this instrument employ resins and other chemicals which give off toxic fumes on incineration. Appropriate precautions should therefore be taken in the disposal of these items.

**RADIO FREQUENCY INTERFERENCE**

This equipment conforms with the requirements of IEC Directive 76/889 as to limits of r.f. interference.

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# Chapter 4-2

## TECHNICAL DESCRIPTION

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## INTRODUCTION

1. The following description should be read in conjunction with the appropriate diagrams in this chapter and with the circuit diagrams in Chap. 7. Descriptions follow the signal path order of r.f. input to display data, and end with the synthesizer, processor and tracking generator.

2. The 2383/2380 spectrum analyzer comprises a lower unit (2383) containing the r.f. signal processing plus an upper unit (2380) containing the display and power supply. Communication is via a two-way serial 9600 baud 20 mA current loop for house-keeping data whilst a one-way high speed serial link is used for the display data. The upper unit's power supply also supplies power to the lower unit.

## CIRCUIT SUMMARY

### Signal path, data conversion and tracking generator

3. The 4.2 GHz RF Unit 2383 has an integral tracking generator and forms with display unit 2380 a swept filter spectrum analyzer covering the range 100 Hz to 4.2 GHz. A block schematic of the 2383 is shown in Fig. 1. With reference to this diagram, the signal to be measured enters via the overload protection circuit. This is a latched change-over relay which is tripped out by any signals over 0.5 W and protects for overloads of up to 20 W. An appropriate annotation is displayed on the screen that this has occurred, and the tripped condition remains until it is cleared by means of a front panel button.

4. The signal is then processed via a conventional up-down multi-stage superheterodyne configuration using a chain of phase coherent oscillators derived by phase locked loop synthesis techniques from the basic 10 MHz reference frequency oscillator. An additional phase coherent oscillator at 502.6 MHz provides the source signal for the tracking generator facility. This signal is frequency translated in a reverse, but otherwise identical, manner to the input signal by means of the second and first local oscillators.

5. The tracking generator signal is amplified by a broad band amplifier and amplitude levelled by an overall a.g.c. loop and is then available for use internally for system calibration via an internal change-over switch, or externally as the stimulus for passive or active frequency domain network analysis.

6. After frequency translation, the input signal is resolved by either a switched bandwidth LC filter, or a switched bandwidth crystal filter, both at 2.6 MHz, depending on the bandwidth required. Bandwidths of 30 Hz and below require the signal to undergo a further down-up frequency translation to 100 kHz to ensure that the filter shape will be sensibly independent of ambient temperature.

7. The translated, filtered input signal is applied to a switched gain logarithmic amplifier system. This switches in extremely accurate attenuator sections to keep the output signal within a 12.8 dB range for an input variation of 89.6 dB. The seven possible values of attenuation needed to achieve this form a 3-bit code to indicate the instantaneous status of this setting. The remaining 12.8 dB of output is detected and A-D converted to an 11-bit word which is processed by a linear-to-logarithmic law PROM and overlapped with the previously mentioned 3-bits of data to form a 13-bit word

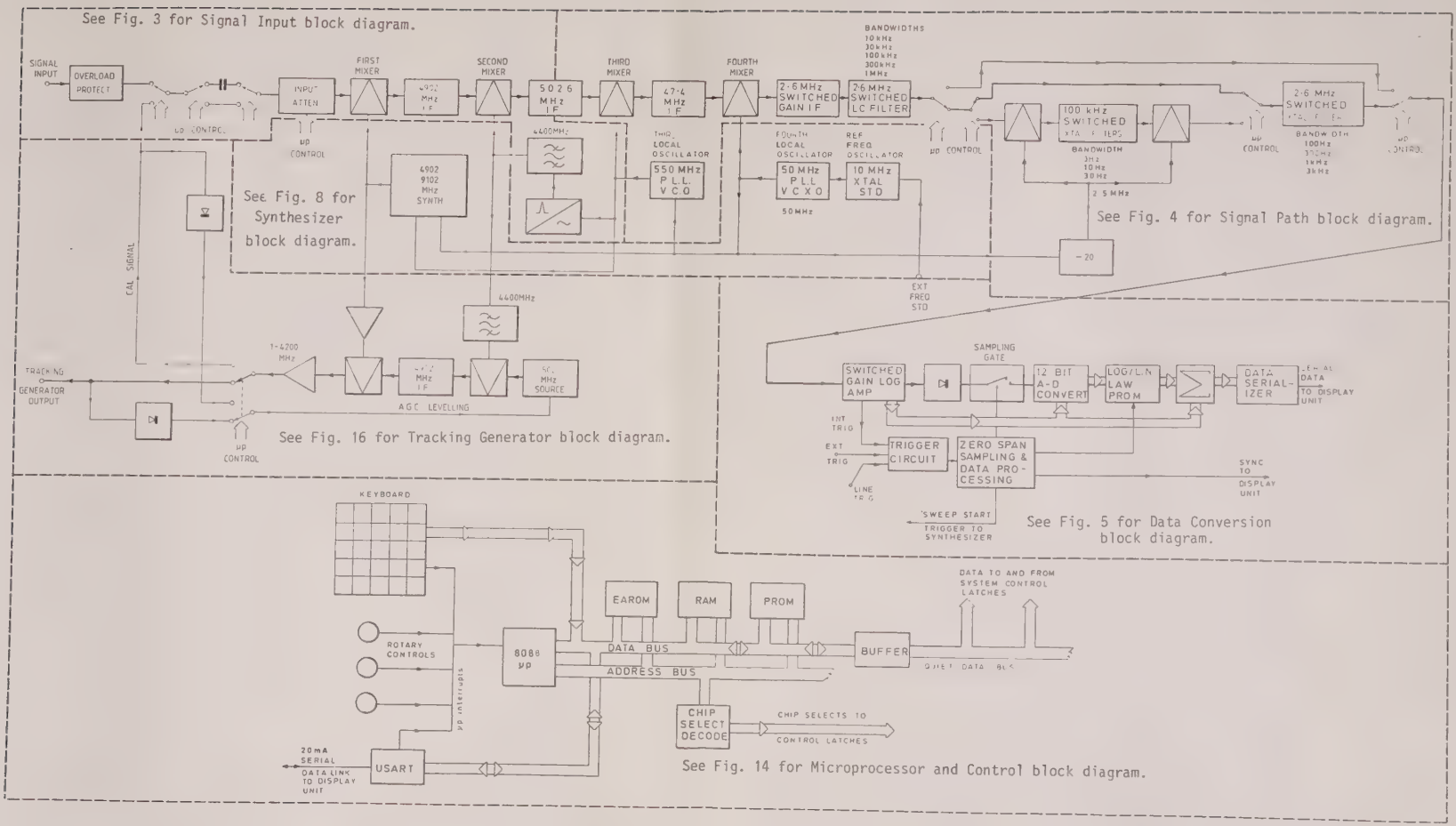


Fig. 1 Block schematic of 2383 System.

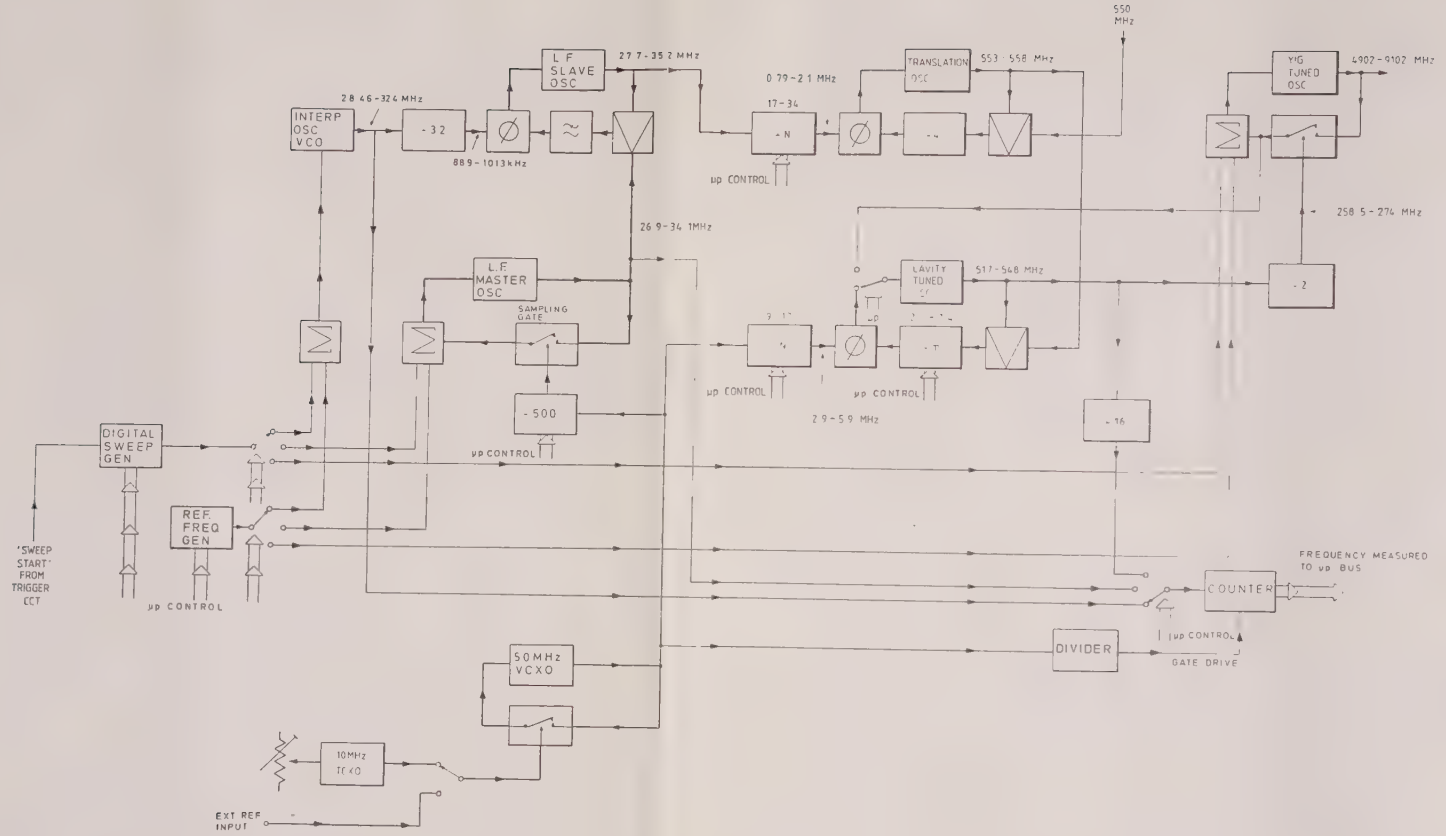


Fig. 2 Block schematic of 2383 Synthesizer.

describing the instantaneous signal level to a resolution of 0.025 dB in a dynamic range of 102.4 dB. A linear data table in the PROM is selected when the 'Volts' display mode is in use.

8. The trigger circuit can select either an internal, external or supply frequency source. The output triggers the sweep start for both frequency and time displays. This facility is essential on the 'Zero Span' mode where the demodulated signal is displayed instead of the frequency spectrum.

9. Finally, the 13-bit word is parallel-to-serial converted and transmitted to the display unit via a single lead at a 2.5 MHz bit rate. A sync out signal is also fed to the upper unit to synchronize the upper unit serial-to-parallel converter.

## Microprocessor and control

10. Front panel controls and the serial link to the upper unit are serviced via microprocessor interrupt procedures organized by a software Real Time Executive residing in the main program. All system switching, control and flag reads are done via a two-way buffer on the microprocessor bus. In this way, the bus wiring in the receiver area is free from the continuous data train of pulses on the normal microprocessor bus thus reducing the possibility of interference to the analogue circuits.

## Synthesizer

11. This is a major sub-system of the 2383 Unit and comprises three master varactor controlled oscillators (see Fig. 2) whose outputs are offset one from the other by linking them via two slave varactor controlled oscillators in a phase locked loop configuration.

### Interpolation oscillator

12. The interpolation oscillator provides continuous frequency coverage at the first l.o. when the l.f. master is phase-locked to a harmonic of a 100 kHz comb. This is a very stable free running varactor oscillator covering the range 28.46 to 32.4 MHz. Before being used as the fine offset frequency in the total system, the output is divided by 32 giving an operational range of 124 kHz at an offset frequency of 889 kHz. This oscillator is swept for spans of 100 Hz to 20 kHz and can be set to a final resolution of 1 Hz anywhere over its 124 kHz of range. By counting its output frequency before division, the divided output can be measured to 1 Hz in a counter gate time of 31.25 ms instead of the 1 second gate time required for direct measurement of the output.

### LF master oscillator

13. This covers the range of 26.9 to 34.1 MHz and can be swept for spans of 50 kHz to 2 MHz or locked at 100 kHz intervals anywhere over this band. Its output is directly counted to monitor its frequency.

### LF slave oscillator

14. This oscillator is permanently locked to the sum of the l.f. master frequency and the interpolation oscillator frequency divided by 32. It is used to add the output of the interpolation oscillator into the next synthesized loop.

Translation oscillator

15. This oscillator generates a signal between 553 and 558 MHz. This signal is phase-locked to the divided sum of the 550 MHz VCO and the l.f. synthesizer. It provides the means by which the l.f. synthesizer can control the frequency of the cavity oscillator and ultimately of the YIG oscillator which provides the first local oscillator signal.

Cavity oscillator

16. This oscillator generates the final output frequency from the u.h.f. part of the synthesizer, which is then multiplied to supply the first l.o. synthesizer. For narrow sweeps this oscillator is offset-locked to the translation oscillator and operates over the frequency range of 518 to 548 MHz. For zero span or for sweeps above 5 MHz the frequency is fixed at 540 MHz. The output is also used by the counter, after division by 16, to enable the oscillator frequency to be monitored.

YIG-tuned oscillator

17. The YIG (Ytterium In Garnet) tuned oscillator provides the first local oscillator and operates in the range 4902 to 9102 MHz.

50 MHz VCXO

18. This is a high purity varactor controlled crystal oscillator used, after division, to drive the sampling gates which lock the l.f. and h.f. master oscillators to precise frequencies when they are not being swept. It, itself, is locked back to the 10 MHz reference frequency standard (either the internal one or the user's external one, if connected) by means of another sampled feedback loop. The 50 MHz oscillator is also used to provide the time base gate period for the counter.

Control voltages

19. The microprocessor system, in conjunction with variable ratio dividers, a digital-to-analogue converter and a tracking integrator, provide a non-linear ramp. This has a magnitude and shape that will produce a linear frequency sweep from the chosen oscillator over the span and reference frequency currently being used.

20. By means of a further microprocessor controlled A/D converter each of the three controlled oscillators is refreshed with its correct tuning voltage during each sweep retrace, the value being retained during the subsequent sweep.

## SIGNAL INPUT

21. Signal input in the range 100 Hz to 4.2 GHz at the INPUT socket is connected to the r.f. attenuators by three input selection switches on AG1 (see Fig. 3). When CAL is selected on the display unit, the processor uses the first switch to select the calibrator input from AE1 in preference to the INPUT socket. The calibration sequence also includes a check of the tracking generator which is the function of the second switch which selects between the signal input and the tracking calibrator. The third switch either inserts a capacitor into the signal path for an a.c. coupled input or, when the DC key is pressed, selects the straight through path. Both the selection logic and the drive for the switch solenoids are provided by AB8 via AT1.

22. For protection purposes the inputs are monitored by AB8 using AG3 to sample the signals. If an overload occurs, the input to the following attenuators is disconnected by AG1 and INPUT OVERLOAD is signalled to the processor. OVERLOAD is then displayed on the screen and the disconnection remains until cleared by the user pressing the INTMD IDENT key. Additional protection is provided for the input mixer by AB8 which leaves the INPUT socket disconnected whenever the instrument is switched off.

23. There are four input attenuators on AG2. The first is a 5 dB attenuator used as a check for intermodulation products when INTMD IDENT is pressed, while the remaining three provide attenuation in the range 10 to 60 dB so that the input to the mixer can be kept below -20 dBm for any input signal. Both the selection logic and the drive for the switch solenoids are provided by AB8 via AT2.

24. The signal is next limited to +20 dBm by AH1 before being passed to the 4.2 GHz low-pass filter and first mixer on AH2. Here the r.f. input is mixed with a 4.9026 to 9.1026 GHz input from the first local oscillator fed in via amplifier board AH6. The difference frequency of 4.9026 GHz is selected as the first i.f. by the directional filter on AH3 and the following band-pass (combline) filter. Amplifier board AH4 provides up to 18 dB of gain (controlled by AH12) before feeding the signal to the second mixer on AH4.

25. To provide the second oscillator frequency, the 550 MHz output from AA9 is amplified by AH8 and fed to the harmonic multiplier on AH9. There the 4.4 GHz band-pass filter selects the eighth harmonic which is amplified on AH10 and fed to power splitter AH11. This board supplies both the tracking generator and, via amplifier AH7, the second mixer. Output at the difference frequency of 502.6 MHz supplies the second i.f. for AA2 and the signal path circuits.

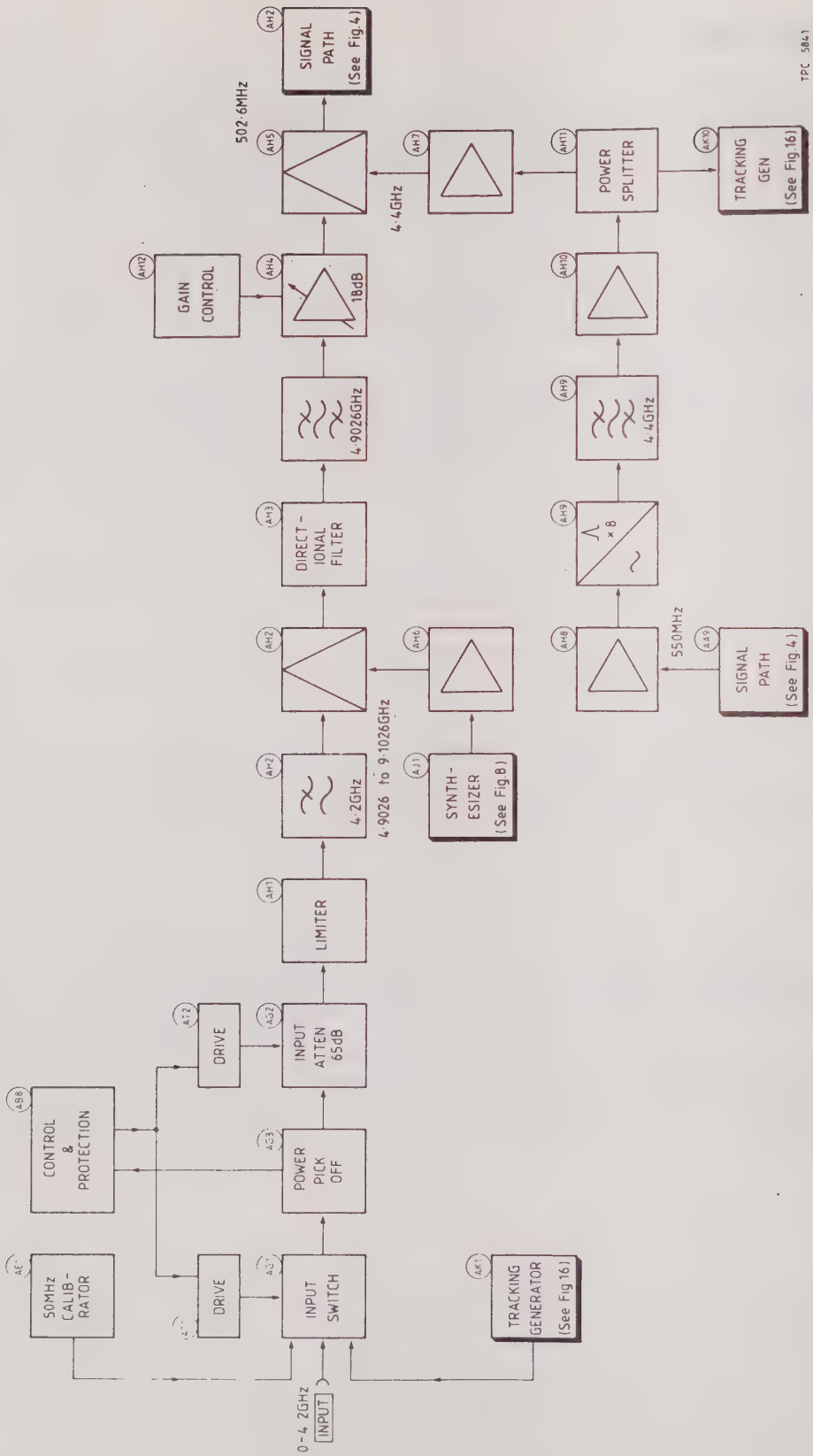


Fig. 3 Signal input block diagram showing main functions of boards.

## Board AB8 - Attenuator control

Circuit diagram : Chap. 7, Fig. 20

26. This board provides three functions :-

a) Interfaces D-A board AB1 via AT1 to input switch AG1, and via AT2 to input attenuator AG2.

b) Detects input overloads and takes protective action.

c) Leaves the input to 2383 open circuit when the power to the instrument has been turned off.

Separate +5 V supplies are used for the coils and the digital circuits.

### Switching action

27. When a change in the settings of AG1 or AG2 is required, the processor sends out change signal CS67 and the rising edge produces a 20 ms negative-going pulse from monostable IC6a. The pulse provides the enable signal for tristate buffers IC1 and IC2. When this occurs, all of the current settings as well as the changed one will switch on one from each pair of solenoid driver transistors TR1 to TR14. Via AT1 these select the alternatives of AC/DC input coupling, signal input/tracking generator and calibrator/INPUT socket. Via AT2 these select any one or a combination of 5, 10, 20 or 30 dB attenuators. Thus current will flow in one coil of every switch on AT1 and AT2, and with 0.5 A in each coil there will be 3.5 A flowing during every setting change. All of the attenuators are active low including the switches on AG1 so that a high logic level selects the straight through position. The purpose of D7 on the +5 V supply line is to ensure that the solenoids do not conduct (and get very hot) when the ribbon cable from AB1 is disconnected.

### Failsafe circuit

28. During normal operation capacitors C6 and C7 will be charged up, with +15 V at the non-inverting input of IC11 and +5.6 V at the inverting input due to the action of Zener diode D5. In this state, the comparator output is high holding TR15 off. The collectors of TR15 and TR13 are connected together via Schottky rectifier diode D6 to ensure that, when power is removed, current does not flow down the falling +5 V line connected to TR13.

29. Whenever the power to the instrument is removed and the supply drops below 5.6 V, the comparator output goes low turning on TR15. This allows storage capacitors C6 and C7 to discharge through TR15 on the IN line to AT1. This in turn causes SWA to select the 50 MHz CAL input and therefore open circuit the INPUT socket thus protecting the input mixer on AH2 from power applied to the instrument when it is switched off. The purpose of D2,D3,D4 and R25 is to produce a constant current source, while R24 gives positive feedback to enhance performance. Diode D1 ensures that, when power is removed, current flows through TR15 and not down the falling +15 V supply line.

Overload detection

30. The overload circuit detects an overload whenever the input power is greater than 26.5 dBm. For this purpose the positive and negative d.c. detected voltages as well as a ground sense from AG3a are brought in at PLAU. These signals are fed to differential amplifiers IC7a and IC7b and then to the high-pass filters on their outputs. A secondary purpose of C1,R13 and C2,R18 is to provide a 0.5 ms time constant to delay the response of the circuit to marginal overload conditions. Comparators IC8 and IC9 follow which compare the two signals with preset voltages from potential dividers R14,R15 and R19,R20. R17 and R21 provide some positive feedback. The open collector outputs of the two comparators are wire-ORed with pull-up resistor R22 connected to l.e.d. D8. When either of the overload limits is exceeded, the O/L SET line is taken low which causes the on-board l.e.d. to illuminate to indicate the overload condition.

31. The O/L SET line is connected to the trip logic circuit which is formed by IC4 and IC5 of which IC5c and IC5d are cross-coupled to form an R-S latch. During normal operation the two inputs to the trip logic circuit, O/L SET and OVERLOAD CLEAR/INHIBIT, are both high causing the OVERLOAD output to be unasserted high. When an overload occurs, the O/L SET line is pulled low which takes the OVERLOAD INTERRUPT line high whose rising edge, via AB1, causes a processor interrupt and results in an OVERLOAD message being displayed. The OVERLOAD line is taken low which disables IC6a and triggers monostable IC6b. IC6b produces a negatively-going pulse which opens gate IC3a to the inverted OVERLOAD signal for the 20 ms required for TR13 to operate switch SWA so as to disable the INPUT socket. With IC6a disabled, buffers IC1 and IC2 are also disabled so that during an overload, current flows through SWA only. After removing the overload, normal operation is initiated by the user pressing the INTMD IDENT key. This takes the OVERLOAD CLEAR/INHIBIT LINE low which causes the trip logic circuit to reset OVERLOAD unasserted high. Besides re-enabling IC6a it causes the processor to send CS67 so that the monostable generates a pulse which switches SWA to reselect the INPUT socket. Internal software is used to disable the overload trip logic for approximately 30 ms at switch-on and whenever an attenuator setting is changed. Table 1 shows the overload detection circuit operation in chronological order downwards starting with normal operation, i.e. no overload detected, and ending, for completeness, with a calibration operation. When IN is shown selected, it means that the instrument is fed from the 50 MHz calibrator with the INPUT socket disabled.

**Unit AG1 - Input switch &**
**Board AT1 - Input switch p.c.b.**

Circuit diagram : Chap. 7, Figs. 49 & 82

32. Input switch unit AG1 contains 3 switches whose solenoids are driven via AT1 from board AB8 which also provides the switch selection logic. Diode pairs D1 to D4 protect against reverse voltage spikes.

33. Switch SWA is used to switch between the INPUT socket when drive current is supplied on the 50 MHz CAL OUT line and the 50 MHz calibration signal from board AE1 when current is supplied on the 50 MHz CAL IN line. Besides this normal use the switch also provides protection by disconnecting the INPUT socket both for overload conditions and to protect the mixer on AH2 from power applied to the instrument when it is switched off.

| | OL/SET | OVER-LOAD CLEAR | 50 MHz CAL | IC5 PINS | | OVER-LOAD | INTER-RUPT | IC6 PINS | | IC3 PINS | | | | | 50 MHz CAL | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 3 | 6 | | | 4 | 12 | 1 | 2 | 5 | 3 | 6 | IN | OUT |
| Normal levels | H | H | H | H | H | H | L | H | H | L | L | H | H | H | - | - |
| Overload occurs | L | H | H | H | L | L | ↑ | H | | H | | L | | H | ↓ | - |
| Overload removed | H | H | H | H | H | L | H | H | H | H | L | L | H | H | - | - |
| Overload clear pressed | H | L | H | L | H | H | L | H | H | L | L | H | H | H | - | - |
| Overload clear implemented | H | H | H | H | H | H | L | | H | L | | H | H | | - | ↓ |
| Select 50 MHz CAL | H | H | L | H | H | H | L | | H | H | | L | | H | ↓ | - |

Events shown in chronological order downwards

TABLE 1 OVERLOAD DETECTION CIRCUIT OPERATION - AB8

34. Switch SWB selects between the input selected by SWA when drive current is supplied on the TG CAL OUT line and the input from the tracking generator calibrator when current is supplied on the TG CAL IN line. The third switch, SWC, selects either a d.c. coupled input when drive current is supplied on the AC/DC OUT line or an a.c. coupled input via an internal capacitor when current is supplied on the AC/DC IN line.

## Unit AG2 - Input attenuator & Board AT2 - 4-section attenuator

Circuit diagram : Chap. 7, Figs. 49 & 83

35. Attenuator unit AG2 contains the four r.f. attenuators of values 5 dB, 10 dB, 20 dB and 30 dB. The 5 dB attenuator is used as a check for intermodulation products when INTMD IDENT is pressed. When this happens, 5 dB of i.f. gain is added, so that if the level is seen to rise, intermodulation is present. The 5 dB attenuator may also be selected by the user pressing the <10 dB key.

36. The solenoids for the attenuator switches are driven via AT2 from board AB8 which also provides the switch selection logic. When drive current is supplied on the IN lines the attenuator pads are inserted in the signal path, and when current is supplied on the OUT lines the straight through path is selected. Diode pairs D1 to D4 protect against reverse voltage spikes.

## Board AG3a - Power protection pick-off

Circuit diagram : Chap. 7, Fig. 49

37. This board is inserted between input switch AG1 and attenuator AG2. Its purpose is to continually monitor the INPUT socket so as to detect when the input signal level is in the range 22.5 to 27.5 dBm. If so, it signals AB8 to operate the switch on AG1 which provides protection by disabling the input.

38. The 0 to 4.2 GHz input signal is picked off the line via a T pad arrangement which has an insertion loss of 0.5 dB. The shunt resistance is divided into two resistors, R3 and R4, to reduce the signal level to the detector zero bias Schottky diodes, D1 and D2. Both positive and negative detectors have a 100 mV/W output to board AB8.

## Board AH1 - Mixer voltage limiter

Circuit diagram : Chap. 7, Fig. 50

39. Input to the limiter is at the 0 to 4.2 GHz signal frequency from attenuator board AG2. The function of the limiter is to protect the mixer diodes on AH2 from input powers in excess of 20 W (no input attenuation) until the overload protection on AB8 has time to operate. AB8 operates by tripping the input switch on AG1 to open circuit which takes about 10 ms. The limiter can be split into two, a high frequency limiter and a low frequency limiter. Up to about 700 MHz, the back-to-back pin-nip arrangement limits the input power to 20 W. The P100/P200 arrangement is a simple voltage clamp circuit. The pin Schottky diode and capacitor arrangement is the upper frequency

limiter. The diode detects the input signal and uses as its video load a P100 diode which shunts the input line. Output, limited to +20 dBm, is to the mixer on board AH2.

40. The two control lines INPUT LINE VOLTAGE MONITOR to AH12 and CONTROL CURRENT back from that board maintain 0 V d.c. on the microstrip line. This is done so as not to upset the balancing action of the d.c. nulling circuit on AH2 which would otherwise occur whenever the input attenuator changes, or if a small d.c. level is applied to the input of the spectrum analyzer.

**Board AH2 - Input filter and 1st mixer**

Circuit diagram : Chap. 7, Fig. 51

41. The instrument input signal in the range 0 to 4.2 GHz from voltage limiter board AH1 is taken to a 4.2 GHz low-pass filter. This is made entirely of printed microstrip components. Input and output matching is achieved with suspended stripline stubs necessitating a milled channel in the block beneath the substrate. A centre stub is used to provide a notch at 4.9026 GHz (the 1st i.f.) and this is tuned with a Johanssen tuning screw mounted in the substrate top cover.

42. To give the first i.f. of 4.9026 GHz, the 0 to 4.2 GHz input signal is mixed with the 4.9026 to 9.1026 GHz local oscillator drive from board AH6. The mixer is a single balanced Marchand balun design utilising a pair of high barrier Schottky diodes in a 'T' package. The balun is of triplate construction and has additional duroid slices in the top cover and in the block beneath the substrate.

43. Suppression of local oscillator leakage from the i.f. port at 4.9026 GHz is achieved by adjusting the voltages on pin diode D3 and varactor diode D4 placed in the i.f. output lines. The bias lines are decoupled by resistor/capacitor networks. Output at the first i.f. is passed on to directional filter board AH3.

**Board AH3 - Directional filter &**
**Unit AH0 (Part) - Combline filter**

Circuit diagram : Chap. 7, Fig. 52

44. Board AH3 provides an i.f. match to the input from the first mixer on AH2. The circuit is a combination of printed components on an alumina substrate and two 50 ohm terminating resistors. The resonant structure of the directional filter is a loop of microstrip whose length is one wavelength at 4.9026 GHz. Two coupled line sections then inject and extract the desired signal. The partially filtered signal at a 300 MHz bandwidth, set by the coupling factor, is fed to the combline filter. This forms part of unit AH0 and is a band-pass filter centred on 4.9026 GHz. Output is connected to i.f. amplifier AH4.

## Board AH4 - 4.9 GHz i.f. amplifier

Circuit diagram : Chap. 7, Fig. 53

45. This board is a thin film circuit fabricated on alumina and contains a number of printed microstrip elements. Input to the board is at the 1st i.f. of 4.9026 GHz from the combline filter. The board contains two single-stage GaAs f.e.t. amplifiers TR1 and TR2 which together provide up to 18 dB of gain. Bias for the amplifiers is supplied by AH12 which operates on the principle of varying the gate voltage to achieve a desired drain current.

46. PIN diode attenuator D1,D2 is situated between the gain blocks to provide the gain control function. This attenuator is a printed 90 degree hybrid and allows variable absorption of energy into 50 ohm loads at the centre frequency while maintaining a good match at the signal ports. Bias current for the pin diodes is supplied by AH12 on the GAIN CONTROL CURRENT line, and is fed in by a 470 ohm printed resistor from a feedthrough on the block. Output directly drives the 2nd mixer on board AH5.

## Board AH5 - 2nd mixer

Circuit diagram : Chap. 7, Fig. 54

47. Local oscillator drive at 4.4 GHz from AH7 converts the incoming signal at 4.9026 GHz from AH4 to the second i.f. of 502.6 MHz. The mixer utilises a pair of high barrier X-band Schottky diodes in a single balanced rat-race configuration. The output line has three open-circuit stubs. Two are at 4.4 GHz and one is at 8.8 GHz to enhance performance and reduce l.o. leakage levels. There is also one short-circuit stub on the l.o. drive line tuned to 4.4 GHz to give a short-circuit termination at 502.6 MHz. The ring is tuned to 4.7 GHz, the mean of the i.f. and l.o. frequencies. The output leaves the AH block via an SMA connector and semi-rigid cable to the AA tray input.

## Board AH6 - 1st l.o. amplifier

Circuit diagram : Chap. 7, Fig. 77

48. AH6 is one of 3 identical boards; the others are AJ2 and AK6. They are all identified as AL1 in Chap. 6, Replaceable Parts and Chap. 7, Servicing Diagrams. The board takes the 4.9026 to 9.1026 GHz ouput from the YTO, amplifies it by 9 dBm, and passes it out via a 3 dB pad to the first mixer on board AH2. TR1, TR2 and TR3 are GaAs f.e.t.s whose bias is supplied from AH12 which operates on the principle of varying the gate voltage to achieve a desired gain current. AH12 also provides protection for the f.e.t.s.

## Board AH7 - 2nd l.o. amplifier

Circuit diagram : Chap. 7, Fig. 78

49. AH7 is one of 3 identical boards; the others are AH10 and AK9. They are all identified as AL2 in Chap. 6, Replaceable Parts and Chap. 7, Servicing Diagrams. The 4.4 GHz input from 2nd l.o. power splitter AH11 is fed to GaAs f.e.t. amplifier TR1 which provides a minimum gain of 7 dB. Bias for TR1 is supplied from AH12 and operates on the principle of varying the gate voltage

to achieve a desired gain current. AH12 also provides protection for the f.e.t. The notch filter on the output removes unwanted harmonics at 3.3 and 5.5 GHz from AH9. Output is to 2nd mixer board AH5.

## Board AH8 - 2nd l.o. multiplier driver

Circuit diagram : Chap. 7, Fig. 55

50. The 550 MHz input from buffer board AA4 is fed to the two-stage amplifier formed by TR1 and TR2. These are common emitter amplifiers which together provide an overall gain of 20 dB. The bias current for TR1 is stabilised by a feedback loop around TR3, while a similar loop around TR4 sets the collector current for TR2. L-section networks are employed at the input and output to match to 50 ohms. Output is to 2nd l.o. multiplier board AH9.

## Board AH9 - 2nd l.o. multiplier

Circuit diagram : Chap. 7, Fig. 55

51. This board converts the 550 MHz signal from AH8 to a 4.4 GHz signal for the 2nd l.o. chain in the receiver and tracking generator.

52. The 550 MHz input from 2nd l.o. driver board AH8 is fed in to a 275 MHz high-pass filter formed by C1 and a printed inductor. A further printed inductor and C2 form a network to match the 50 ohm filter to the impulse generator. The impulse generator consists of a printed inductor and step recovery diode D1. The action of this circuit is similar to a car's ignition system, with the printed inductor in place of the ignition coil and the diode in place of the contact breaker. On the positive half cycle the diode conducts and stores the charge. When the current reverses the diode continues to conduct until the stored charge is used up. The diode then switches off very rapidly and the inductor resonates with the off capacitance of the diode to give a negative impulse. The inpulse travels along the ringing line formed by the transmission line and a printed capacitor. This combination is a quarter of a wavelength long at 4.4 GHz. The impulse reaches the capacitor and is partially transmitted and partially reflected with no phase change. The reflected pulse travels back up the line and is re-reflected from the diode which is now conducting again. Since the diode is low impedance the re-reflected pulse is inverted. Hence this pulse arrives for the second time at the printed capacitor half a cycle later and inverted in phase. This process continues, producing a decaying sine wave into the coupled line output filter. The 4.4 GHz band-pass filter, formed entirely from microstrip transmission lines, selects the required multiple (X8) of the input and rejects the others. Both parts are mounted on a single alumina substrate with the multiplier protected by a plastic cover. Output is fed to 2nd l.o. amplifier board AH10. A fixed bias current is fed from AH12 through R1 and R2.

## Board AH10 - 2nd l.o. amplifier

Circuit diagram : Chap. 7, Fig. 78

53. AH10 is one of 3 identical boards; the others are AH7 and AK9. They are all identified as AL2 in Chap. 6, Replaceable Parts and Chap. 7, Servicing Diagrams. The 4.4 GHz input from 2nd l.o. multiplier board AH9 is fed to GaAs f.e.t. amplifier TR1 which provides a minimum gain of 7 dB. Bias for TR1 is supplied from AH12 which operates on the principle of varying the gate voltage to achieve a desired gain current. AH12 also provides protection for the f.e.t. The notch filter on the output removes unwanted harmonics at 3.3 and 5.5 GHz from AH9. Output is to power divider board AH11

## Board AH11 - 2nd l.o. power splitter

Circuit diagram : Chap. 7, Fig. 56

54. This board divides the output of AH10 at the 2nd l.o. frequency equally between receiver block AH and tracking generator block AK. The circuit consists of a single loop narrow-band Wilkinson power divider centred at 4.4 GHz, and provides 20 dB of isolation between the receiver and tracking generator i.f. strips. It is mounted on an alumina substrate and uses printed thin film microstrip elements. Outputs are to AK10 and AH7.

## Board AH12 - Receiver p.s.u. distribution

Circuit diagram : Chap. 7, Figs. 57 & 58

55. Board AH12 supplies power, bias and control information to the circuits in the receiver (AH) block as follows:-

(1) Input d.c. stabilization: This keeps the input d.c. conditions constant so that the first local oscillator (d.c. marker) nulling performed on first mixer board AH2 is not upset when the input attenuator changes, or if a small d.c. level is applied to the input of the spectrum analyser.

(2) DC marker nulling control. There are two, largely independent, adjustments using a varactor and a pin diode on AH2. AH12 provides voltages in the correct ranges.

(3) Bias for the GaAs f.e.t. amplifiers on AH4, AH6, AH7 and AH10.

(4) Bias current for the multiplier step recovery diode on AH9.

(5) Gain setting current to the pin diodes on AH4, which control the 1st i.f. gain.

Supply filtering (Sheet 1)

56. Filtering of the supply rails is done by C1, C2, L3 and C3. D10 allows the board to operate without latching up in the event of the -15 V supply being absent.

Input d.c. stabilisation

57. The VOLTAGE MONITOR line from AH1 carrying the instrument input signals is fed to op-amp IC1a. The feedback loop around IC1a attempts to maintain its inverting input at ground potential to match the non-inverting input. This occurs when the input is also at ground potential.

58. If this circuit were absent, small d.c. voltages could be set up on the input line due to the diode imbalance in the input mixer on AH2. As the input attenuator changed, so the voltage would change slightly, upsetting the delicate balancing action of the d.c. marker nulling on the mixer. The d.c. stabiliser maintains a constant input d.c. voltage, and so is also able to correct for the presence of applied d.c. at the front panel input (up to 0.5 V with an input attenuator pad in circuit).

59. The circuit is designed to respond slowly to changes at the input so as not to lose low frequency input signals. However, in order to allow the d.c. marker nulling to operate quickly, for instance when the attenuator is changed, TR1 is turned on under processor control which greatly shortens the time constant of the circuit. TR1 is switched by comparator IC2d which detects the changes of logic level. TR1 is also set to the fast position on wide sweeps to allow the circuit to follow the relatively rapid changes in mixer imbalance across the sweep.

DC marker null

60. The two DC MARKER NULL lines from the D-A converters on AB1 each carry d.c. voltages in the range 0 to 10 V. One line controls a varactor diode on 1st mixer board AH2 and since this requires 0 to -10 V, inversion is provided by IC1b. C5 gives the stage a low-pass characteristic to reduce noise fed to the mixer which could result in phase modulation. The other voltage line feeds a pin diode on the mixer. Only a fraction of the available 10 V is supplied to any one mixer, but the whole range is capable of being utilised to cope with variations between devices. R97 sets the voltage range so that full use is made of the D-A converter's resolution, and a variable offset voltage from R96 (derived from the 12 V supply described later) is summed with this at the summing point of IC1c. The voltage is then re-inverted to feed the pin diode. C6 provides noise filtering.

FET bias supply and protection

61. There are seven similar bias regulator stages on this board all fed from the voltage reference. This is a resistor chain formed by R16 to R19 which supplies 10 V, 8 V and 6 V derived from the +15 V rail. The bias circuits are designed to fulfil the following aims:-

(1) Provide GaAs f.e.t. bias (8 V or 6 V drain voltage at 45 mA or 40 mA nominal drain current).

(2) Provide protection for the GaAs f.e.t.s and the bias components on the board when the gate feedthrough capacitor connection is missing, or a short to ground occurs on either the gate or the drain feedthroughs.

62. Only one of the bias stages is described below but it will serve for all. The positive supply which feeds the drain current comes from TR7 emitter. IC2a provides high impedance buffering to the 10 V reference via R26, and feedback ensures that TR7 emitter is at 10 V. 3 V Zener diode D2 in the collector of TR7 reduces the transistor dissipation, and keeps this to a safe value in the event of a short on the drain feedthrough capacitor. R27, R28 and R29 set the drain current, a parallel combination being used to avoid over-dissipation in the event of a drain short. If excessive drain current flows, the voltage across the current-setting resistors rises. When the voltage across R28 reaches 0.7 V, TR6 conducts, pulling down the drain supply by drawing current through R26 and limiting the drain current to 70 mA. The higher the temperature, the lower the current at which the protection circuit will start to cut in.

63. Drain voltage stabilisation is provided by a negative feedback circuit around TR2, TR3 and TR5. TR2 and TR3 form a long-tailed pair which compares the drain voltage with the 8 V reference and feeds an error signal to the f.e.t. gate. The action of the negative feedback is to provide gate bias to bring the drain voltage to 8 V, with an error caused by the difference in base voltages between the two transistors. TR5 provides the current required for the gate bias of the f.e.t. amplifier. Although GaAs f.e.t.s are high input impedance devices and require negligible gate current, the gates are shunted by 200 ohm resistors which provide a match at 4.4 GHz. Since TR5 is a common emitter amplifier with the collector load resistor grounded, the f.e.t. gate cannot be taken positive. If the gate connection is shorted to ground, with the highest current gain device for TR5, this transistor could over-dissipate. To prevent this TR4 robs TR5 of base current when the emitter current of TR5 exceeds 35 mA. C7 provides frequency compensation to keep the stage stable and reduce the gain at high frequencies.

Multiplier bias (Sheet 2)

64. Multiplier board AH9 is supplied with bias current by IC4a and IC4c. For this purpose, a 12 V rail is derived from the 15 V rail by Zener diode D9, which is thus stabilised against 15 V rail variations. The supply is heavily filtered by R92,C14 to avoid supply and Zener diode noise from being fed into the i.f. amplifier or multiplier, possibly giving rise to unwanted amplitude or phase modulation. IC4a is a high impedance buffer and provides a low impedance 12 V. This op-amp is a bipolar type with a small but measureable input bias current. Equal bias currents flow through R91 and R92 so that IC4a output equals the Zener diode voltage. Thus IC4c feeds multiplier board AH9 with a fixed bias current. IC4a output is also taken to supply the d.c. marker null circuit.

Receiver gain

65. Also connected to IC4a output is IC4b which provides the gain setting current for the lst i.f. amplifier on board AH4. R98 is used to set the receiver block overall gain.

## SIGNAL PATH

66. The signal at the second i.f. from AH5 is connected to amplifier board AA2 which provides a gain of 5 dB (see Fig. 4). Band-pass filter board AA3 which follows selects the difference frequency of 502.6 MHz from the second mixer for passing to the third mixer on board AA3a. Here the second i.f. is mixed with a 550 MHz input from the third local oscillator on board AA9. AA9 with AA10 phase locks the third l.o. with the fourth l.o. on board AC1. The AA3 low-pass filter selects the 47.4 MHz difference frequency for output to AC2.

67. The 47.4 MHz third i.f. to AC2 is fed to the fourth mixer via an amplifier, a notch filter and a band-pass filter. An auxiliary output is tapped off and taken to the 47.4 MHz OUTPUT socket on the rear panel. The 50 MHz varactor controlled crystal oscillator on AC1 is normally locked to the fifth harmonic of the 10 MHz standard oscillator on AD4 by means of circuitry on AC6. However, if an external standard is in use, the sampling gate on AC6 produces an output that will cause the 50 MHz oscillator to lock on the appropriate harmonic. This 50 MHz signal is amplified and drives the l.o. port on the fourth mixer. The resulting 2.6 MHz difference frequency forms the fourth i.f. which is passed for level control to a three stage 50 dB attenuator and a 30 dB amplifier as well as to a further 30 dB attenuator and 30 dB amplifier on AC3. Together these control the i.f. gain in 10 dB steps from -20 to +60 dB.

68. Board AC3 contains 5 LC filters providing selected signal bandwidths of 10, 30, 100, 300 and 1000 kHz. For the narrow bandwidths of 3, 10 and 30 Hz board AC4 down-converts the 2.6 MHz i.f. to 100 kHz and, after feeding the signal through the required crystal bandwidth filter, up-converts it back to 2.6 MHz. The 2.5 MHz used by the mixer is derived from a divided 5 MHz from AC6. A filter bypass is provided for broader bandwidths. The 20 dB amplifier on AC5 is followed by 4 crystal filters which provide bandwidths of 100, 300, 1000 and 3000 Hz. For data conversion prior to display, a switch on AD1 selects the input from either AC3 or AC5 appropriate to the selected filter path.

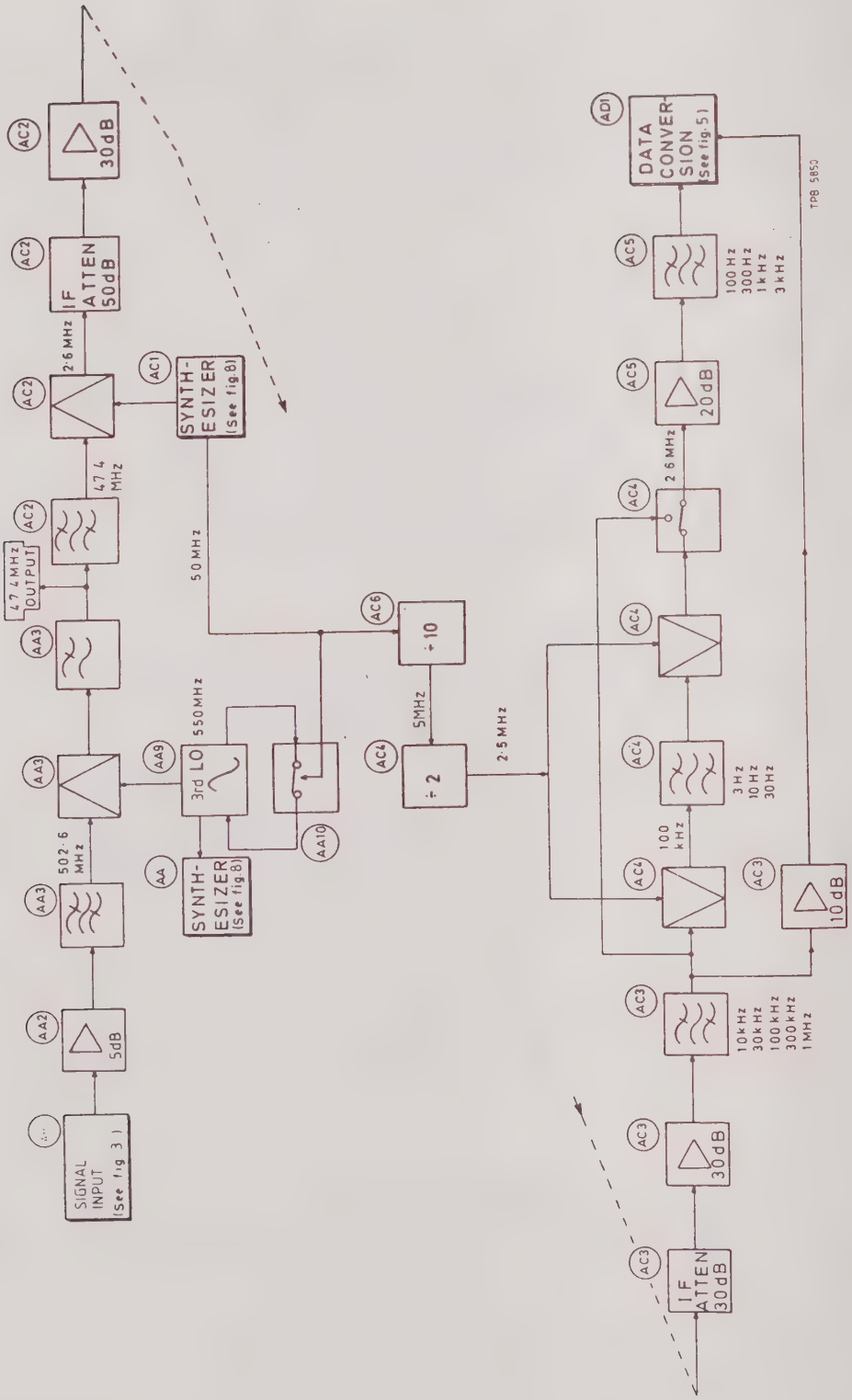


Fig. 4 Signal path block diagram showing main functions of boards.

## Board AA2 - 502.6 MHz amplifier

Circuit diagram : Chap. 7, Fig. 2

69. Input from second mixer board AH5 is fed to second i.f. amplifier TR5. Feedback component R18 provides both the required stage gain of 5 dB and, in conjunction with R13, R14 and L4, an input impedance of 50 ohms over a broad band around 502.6 MHz.

## Unit AA3 - 502.6 MHz band-pass filter & Board AA3a - 3rd mixer

Circuit diagram : Chap. 7, Fig. 2

70. Band-pass filter AA3, which has a bandwidth of 7 MHz, selects the 502.6 MHz output from mixer board AH5 for passing to board AA3a. On board AA3a this signal supplies one input to dual-gate m.o.s. f.e.t. mixer TR1 whose other input is from third l.o. board AA9. TR5 supplies the bias for TR1. Local oscillator input at 550 MHz is applied to the buffer formed by TR2 and TR3 and then to the mixer via driver TR4. Trimmer C8 allows the output matching network to be tuned for maximum gain at the resulting third i.f. of 47.4 MHz selected by the l.p. filter.

## Board AA9/1 - 550 MHz v.c.o.

Circuit diagram : Chap. 7, Fig. 9

71. This board generates the third l.o. signal which is phase locked to the instrument 50 MHz reference by board AA10/1. Besides the 550 MHz fixed oscillator, the board contains the buffers and power splitters to provide gain and isolation for three 550 MHz outputs.

72. Oscillator frequency is determined by the parallel tuned circuit of which the capacitive arm consists of paralleled varactor diodes D1 and D2 in series with preset trimmer C6. The voltage from AA10/1 on the V TUNE line is approx. +5 V when the frequency of Hartley oscillator TR1 is correctly set to 550 MHz. The inductive feedback path from TR1 collector via C10 and R5 is mutually coupled in L3. Oscillator collector current of 20 mA is determined by emitter resistor R4. Components R8,R9,C11 and C12 compensate for transistor phase shift and prevent parasistic oscillations. Output is taken from L3 at a low tapping point via R10 to 75 ohm hybrid v.h.f. amplifier IC1. Divider R13,R14 matches the 75 ohm impedance of IC1 output into a 50 ohm source for the first power splitter. This is formed by T1,T2 and has two outputs; one going via buffer TR9 to AA4, the other to one-transistor buffer TR3 and then into a second power splitter T3,T4. Each power splitter has 3 dB power loss between input and output port. Buffer amplifiers TR3 and TR9 are required to provide 50 ohm loading for power splitter T1,T2 and to compensate for the 3 dB loss. Each has 5 dB gain and 25 dB of reverse isolation. From T3,T4 one output goes through a 3 dB pad to two-transistor buffer TR4,TR5 and out to AA3a at +5 dBm, while the other output goes through a 3 dB pad to a similar two-transistor buffer TR6,TR7 and then out to AA10/1 at +5 dBm. The two-transistor buffers have approximately 60 dB of isolation and 10 dB of gain. This isolation is necessary to stop tracking generator and sampling gate harmonics from leaking into the receiver. The oscillator board is provided with clean supply lines by line cleaner AA11.

## Board AA10/1 - 550 MHz phase detector

Circuit diagram : Chap. 7, Fig. 9

73. This board locks the 550 MHz generated by the AA9/1 v.c.o. to 11 times the 50 MHz crystal reference frequency from AC1. Phase comparison is performed in a sampling gate to provide an error signal which is integrated in a loop filter to provide the tuning voltage for AA9/1 so as to to phase lock the two signals.

### Buffer amplifier

74. The 550 MHz input from AA9/1 is buffered by TR1 which is a high isolation amplifier providing 5 dB of gain. The amplified signal is fed to the sampling gate input at a level of +10 dBm, equivalent to 1 V peak amplitude.

### Pulse generator

75. TR2 amplifies the 50 MHz reference signal from AC1 and feeds the primary of pulse transformer T1. The low impedance secondary drives current through L4, diode D5 and L5 on one half cycle. During the opposite half cycle, D5, being a step recovery diode, switches to the off state almost instantaneously thereby generating short duration voltage pulses shaped by L4,C13 and L5,C14. The equal and opposite amplitude pulses, positive-going on D5 cathode and negative-going on D5 anode, turn on the sampling gate for the pulse duration.

### Sampling gate

76. The sampling gate performs the function of the loop phase detector. The positive- and negative-going pulses generated by D5 turn the sampling gate diodes on for a short duration at a 50 MHz rate; during this on period the sampling gate input voltage is transferred to C10. Thus the 550 MHz input signal is sampled every 11th cycle, and any error voltage is stored on C10. IC1 buffers the sampling gate from the following circuit and provides a low impedance drive to the search oscillator. When phase locked, IC1 output voltage on TP3 is nominally 0 V and the sampling gate bandwidth is approximately 2 MHz.

### Search oscillator

77. IC2a is configured as a Wien Bridge oscillator operating at a frequency of 4 Hz determined by R23, C23, R24 and C24. When phase locked, the overall gain around the loop is very high; this applies negative feedback across the Wien Bridge thereby inhibiting oscillations. IC2a then behaves as an inverting amplifier with a gain of 10/3. At switch-on, or if lock is lost, the loop gain is insufficient to suppress the search oscillator which produces a 4 Hz waveform with output limited by the action of D6 and D7 to +/- 2 V. This forces the output of the integrator loop filter to ramp, sweeping AA9/1 v.c.o. frequency until a phase lock is found.

### Loop filter

78. IC2b is configured as an integrating loop filter which integrates any error voltage from the sampling gate to produce the tuning voltage for the V TUNE line to the 550 MHz v.c.o. on AA9/1. D8 sets the lower limit of V TUNE by preventing IC2b output from falling below -0.6 V. The upper limit of +9 V

is determined by the search limiter circuit. These limits ensure that the v.c.o. locks at 550 MHz rather than at the alternative locking points of 500 MHz and 600 MHz. When V TUNE exceeds the +9 V set by potential divider R31.R32,R33 comparator IC3a output goes high turning f.e.t. TR3 on. The TR3 on resistance is controlled by the negative feedback maintaining V TUNE at + 9 V. With TR3 switched on, the positive current flowing through R30 and TR3 exactly cancels the current flowing out of the integrator through R25 into the search oscillator. When V TUNE is less than +9 V comparator IC3a output is low, so that TR3 is biased off and has no effect on the integrator action. IC3b provides a voltage source of +6 V at PLPN which may be used as a preset tuning voltage in the adjustment of the AA9/1 v.c.o.

## Board AC2 - 47.4 MHz i.f. amplifier

Circuit diagram : Chap. 7, Fig. 23

79. This board mixes the 47.4 MHz third i.f. with 50 MHz from the crystal oscillator on AC1 to produce the 2.6 MHz fourth i.f. The 50 dB switched attenuators form part of the i.f. level control system.

### Mixer

80. The 47.4 MHz input from AA3a is applied to 7 dB amplifier TR1 as well as to output buffer TR2 which supplies the rear panel 47.4 MHz OUTPUT socket. TR1 connects the signal to the mixer through a notch filter operating at the mixer image response of 52.6 MHz; the notch is tuned by C4 and the null depth is set by R21. The following 1 MHz band-pass filter consists of four coupled resonators whose output is fed via TR5 to the sources of dual f.e.t. TR6. TR5 with TR7 and TR8 form a single balanced mixer. R29 at the emitter of TR5 provides compensation to prevent variation between f.e.t's affecting the inter modulation performance. Drive for the mixer is supplied by 50 MHz from AC1 via tuned buffer TR3 which supplies the antiphase switching signals to the gates of the mixer f.e.t's.

### Level control

81. Output from the mixer passes into a three stage attenuator operating under processor control. Output from the mixer passes through unattenuated when high logic levels applied on the control lines to level shifters IC4b, IC4d and IC2a switch on f.e.t's IC1a, IC1c and IC3a respectively. Low logic levels on these lines are used to switch on f.e.t's IC1b, IC1d and IC3b which insert 20 dB, 10 dB and 20 dB of attenuation respectively. The i.f. level control of this board and of the 30 dB attenuator and amplifier on the following AC3 board enables the i.f. gain to be controlled in 10 dB steps from -20 to +60 dB.

## Board AC3 - 2.6 MHz LC filter

Circuit diagrams : Chap. 7, Figs. 24 & 25

82. This board provides the 10 kHz, 30 kHz, 100 kHz, 300 kHz and 1 MHz resolution bandwidths at a centre frequency of 2.6 MHz. The filter is always in circuit regardless of overall resolution bandwidth, its output being routed to the log amp or other filters as required. The board also contains part of the i.f. variable gain system the remainder of which is on 47.4 MHz i.f. board AC2.

### Attenuator and variable gain amp

83. The output signal at the 2.6 MHz fourth i.f. from AC2 is connected to the switched 0/30 dB attenuator formed by R1,R2 and switches IC1a,b. A high logic level from AD38 to drivers IC2a,b switches on IC1a to enable the signal to pass through unattenuated, a low switches on IC1b to route the signal via potential divider R1,R2 attenuating the signal by 30 dB.

84. The following 30 dB variable gain amplifier consists of feedback pair TR1,TR2 with gain control from pin diodes, D1,D2 in TR1 emitter. The diodes operate as current controlled resistors to the GAIN ADJUST input from AB1 and provide about 12 dB of control over the stage. Output to the following switched bandwidth filters is via buffer amplifier TR3,TR4.

### Switched bandwidth filters

85. By driving the LC sections of the five filter stages from four switched impedances, bandwidths of 30 kHz, 100 kHz, 300 kHz and 1 MHz are produced. Control logic on the bandwidth select lines to drivers IC8a,b,c and d operate switches IC3,4,5,6 and 7 to route the input signal through the appropriate impedance. For the 10 kHz bandwidth all switches are open. For example, for the first switched BW filter, a low on the 30 kHz SELECT line to the inverting input of IC8a switches on IC3a and the input signal is routed through R35 in parallel with R34. Each LC filter includes a varactor diode connected to the CENTRE FREQ ADJ line to enable the processor to correct frequency drift, for bandwidths of 10 kHz and above, via a D-A converter on AB1.

### Buffers

86. Each stage is buffered by a 'white emitter follower' which provides the very low output impedance necessary for wide i.f. bandwidths. Each stage uses a positive feedback circuit which makes the dynamic resistance of the LC section effectively infinite at resonance, so no insertion loss compensation is required when changing bandwidths. Thermistors in the feedback loop

compensate for changes in inductor Q, and thus filter insertion loss, with temperature.

Output routeing

87. Output is connected to either log amp board AD1 or, if a bandwidth narrower than 10 kHz is required, to 100 kHz crystal filter board AC4. Connection is by quad switch IC9 driven from level shifter IC10. A low logic level from the microprocessor to IC10b inverting input switches on IC9b and c to select output to AD1, and switches on TR17 to enable centre frequency tuning. If this board is not controlling the overall i.f. bandwidth, TR17 is off and the filter's centre frequency is set by potential divider R147 and R148. When the LC filters are defining the bandwidth, the top of screen level is 10 dB lower than that required by the log amp. For this reason, output to AD1 is via 10 dB series feedback amplifier TR18.

## Board AC4 - 100 kHz i.f. crystal filter

Circuit diagrams : Chap. 7, Figs. 26 & 27

88. This board provides the 3, 10 and 30 Hz bandwidths at a centre frequency of 2.6 MHz. The signal is mixed down to 100 kHz, amplified and passed through 5 crystal filter stages before being mixed back up to 2.6 MHz. Overall gain to signals at 2.6 MHz is +10 dB. A signal bypass route for the broader resolution bandwidths is provided.

Down mixer and switched gain amp

89. Signal input from AC3 at the fourth i.f. of 2.6 MHz is selected either for input to the mixer or to bypass the crystal filters. Selection is by logic from AD38 on the BYPASS CONTROL line to level shifters IC11a,b. For a low logic level, f.e.t's IC1c at the input and IC7c at the output switch on to route the signal past the filters as well as to inhibit mixer drive. For a high logic level, IC1d enables mixer operation and connects the bypass line to ground while IC7d selects output from the filters. Drive for the down mixer is derived from the 5 MHz input from AC6 applied via a 1 MHz high-pass filter. The signal is divided by IC2a and the resulting 2.5 MHz is applied to mixer f.e.t's IC1a and b. The difference frequency of 100 kHz is fed to switched gain amplifier TR1,TR6 and TR7 which recovers mixer loss and is switched via IC3a and b to compensate for changes in filter insertion loss with changes in bandwidth. TR1 and TR6 form a series/shunt combination with feedback buffered by emitter follower TR7. Amplifier gain is varied by switching the emitter load of TR1 and this is accomplished using the same logic from AD38 on the BANDWIDTH lines that is used for filter selection. Gain for 30 Hz, 10 Hz and 3 Hz is set respectively by presets R17,R15 and R13.

Crystal filters

90. There are five crystal filter stages. The crystals are adjusted for centre frequency by the preset capacitors C23,43,63,83,103 and then trimmed by varactor diodes D1 to D5 under microprocessor control on the CENTRE FREQ ADJUST line from AD38. Each crystal is buffered by an emitter follower (TR7,9,13,15,19). The crystal parallel capacitance is nulled by the variable gain inverting stage TR8,10,14,16,20 which feeds forward around the crystal. Stray capacitance on the crystal load resistor is tuned out by L2 to L6 and C32,52,72,92,112. The bandwidth of each stage is varied by resistors

switched into circuit by open-collector t.t.l. gates. To ensure that the 'off' impedance of the gates is high, the load resistors are returned to +5 V and d.c. blocked by C30,50,70,90,110. In between stages 4 and 5, amplifier TR18 boosts the level to give the required overall 10 dB gain. Filter selection is by logic on the BANDWIDTH selection lines to gates IC3, 4 and 5.

### Up mixer and output

91. Filter output is taken via buffer TR21,TR22 to the up mixer. Mixer drive, supplied at 2.5 MHz from IC2b, is applied from isolators IC6 to switches IC7a and b. Mixer output reconverts the 100 kHz used for the bandwidth filters to the 2.6 MHz fourth i.f. Also at the output are f.e.t. switches IC7c and d. These enable the signal to bypass the filters when IC7c is switched on and IC7d is switched off.

## Board AC5 - 2.6 MHz crystal filter

Circuit diagrams : Chap. 7, Figs. 28 & 29

92. This board provides the 100 Hz, 300 Hz, 1 kHz and 3 kHz resolution bandwidths at a centre frequency of 2.6 MHz by means of 5 crystal filter stages.

### Switched gain amplifier

93. The input signal at the 2.6 MHz fourth i.f. from AC4 is connected to the 20 dB switched gain amplifier. This consists of TR1 and TR4 in a series/shunt feedback combination with feedback buffered by emitter follower TR5. Amplifier gain is varied by switching the emitter load of TR1 and this is accomplished using the same logic from AD38 on the SELECT lines that is used for filter selection. A low on either the 100 Hz or 300 Hz SELECT line switches on TR2 or TR3 respectively. Respective gain settings are by presets R7 and R11.

### Crystal filters

94. There are five crystal filter stages. The crystals are adjusted for centre frequency by the preset capacitors C12,22,33,42,53 and then trimmed by varactor diodes D1,6,11,16,21 under microprocessor control on the CF ADJUST ENABLE line from AD38. This is taken low to switch on TR16 to enable the CENTRE FREQ ADJUST output from the D-A converter on AB1 to be used to optimize the filter tuning. Each crystal is buffered (TR5 to TR13). Stray capacitance on the crystal load resistor is tuned out by L2 to L6. Filter selection is by logic on the bandwidth SELECT lines to drivers IC1a,b and c which control diode switches D2-4,7-9,12-14,17-19,22-24. Output to AD1 is via buffer TR14,TR15.

## DATA CONVERSION

95. The 2.6 MHz fourth i.f. from AC5 is selected at the required bandwidth at the input of AD1 (see Fig. 5). Here, an output is taken to AD2 to provide the video trigger used for display synchronizing purposes. The main path leads to paired attenuators and amplifiers. The attenuators are switched in or out of circuit as required to produce an analogue signal of 12.8 dB or less at the output. The attenuator settings necessary to produce this result provide a digital output capable of indicating 7 multiples of 12.8 dB. Total resolution, analogue and digital, is thus 102.4 dB. Additionally, a signal output, squared and at t.t.l. levels is supplied to AD2 for frequency measurement purposes. A precision detector connects the output to the audio amplifier on AR1 as well as to a sample and hold circuit for A/D conversion by AD2.

96. Board AD2 contains the A/D converter which changes the analogue input from AD1 to an 11-bit word. Depending upon mode of operation, this accesses the logarithmic or linear field of a look-up table held in EPROM. In the logarithmic case, the result is summed with the digital input from the AD1 attenuators. Additionally, when INTMD IDENT is pressed, the summer compensates for the 5 dB pad inserted on unit AG2. The parallel output from the summer is converted to a 23-bit data word which is serially clocked out for display by 2380.

97. The various display modes used in both frequency and time depend upon the occurrence of synchronizing pulses. These are produced from the external, video, line or 10 MHz trigger inputs. The synchronizing pulses cause the data for display to be sampled either at a constant rate or at intervals determined by the sampling interval counter and the incremental delay generator.

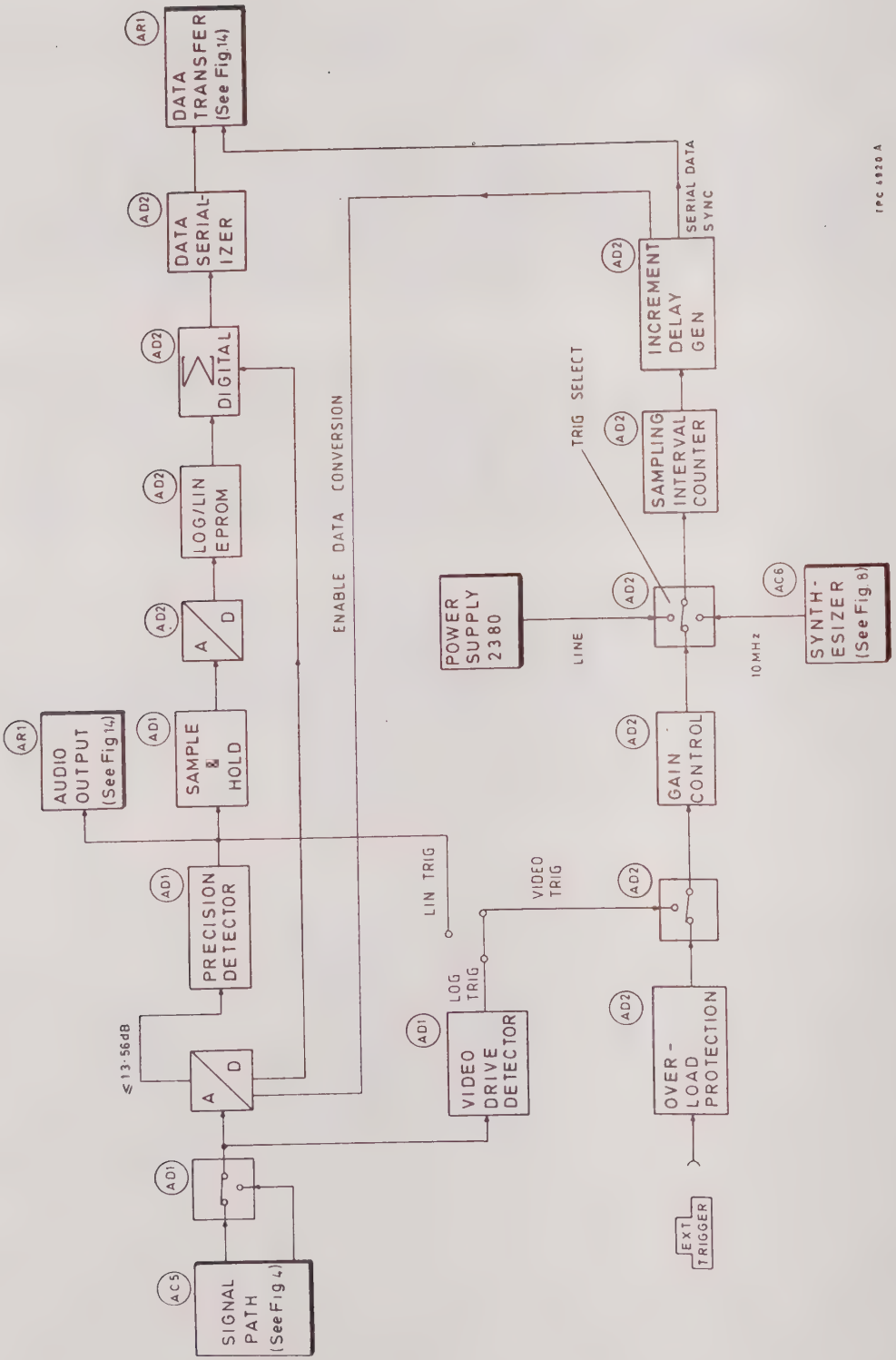


Fig. 5 Data conversion block diagram showing main functions of boards.

## Board AD1 - Log amplifier

Circuit diagrams : Chap. 7, Figs. 32 & 33

### General

98. The logarithmic amplifier works by auto-ranging the input signal producing an analogue voltage output linearly proportional to the amplitude of the 2.6 MHz input signal over a 12.8 dB window, and a digital output which tells log amp interface AD2 into which of 8 such windows the signal fits. Thus the log amp is capable of reading an 8 x 12.8 dB dynamic range i.e. 102.4 dB. In the logarithmic mode the analogue output is converted to a log scale by a look-up table on AD2 to give a final resolution of 0.025 dB. For linear, voltage measurements, the logarithmic function is over-ridden and the amplifier stages are preset. For linear scales of 1 V, 2 V, 10 V etc., amplification is set to 25.6 dB while for scales of 5 V, 50 V etc., amplification is set to 13.56 dB. Auxiliary outputs are provided at the 2.6 MHz fourth i.f. for accurate frequency measurements on the user input signal, and at the detected output for audible-monitoring of the detected/demodulated output.

### Input selection

99. Logic from AD38 on the BYPASS SELECT line to the level shifters forming IC1 controls the operation of f.e.t. switches TR2 and TR3. A low logic level switches on TR3 to select input from LC filter board AC3, a high switches on TR2 to select input from crystal filter board AC5. The selected input at the 2.6 MHz fourth i.f. is amplified by TR4,TR5 and buffered by TR6. An output from the emitter of TR4 to the precision trigger drive detector formed by TR39 to TR41 provides the LOG TRIG output to the AD2 board which is used for data transfer synchronizing purposes.

### Overrange detectors

100. These detect the input level at each amplifier stage and switch each stage to 0 dB gain if the level exceeds -9.6 dBm, since this would correspond to an output level of +16 dBm from a stage with +25.6 dB gain. The first level detector consists of C9 with switch TR7 which operates as a fast response detector. Hold capacitor C9 is charged from TR7 and is discharged by the conduction of TR8 via D4. Thus the voltage on C9 applied to comparator IC3 is caused to track the input signal. The detectors have a very fast 'attack' speed but decay is slow, so it is necessary to reset them just before each conversion is made. This is carried out by TR8 for the 25.6 dB stages and by TR30 for the 12.8 dB stage. The reference for the non-inverting input of comparator IC3 is supplied by the potential divider R33,R34. IC3 output forms the data input for D-type latch IC4a. The remaining overrange detectors are similarly configured.

### Attenuators and amplifiers

101. There are three switched 25.6 dB attenuators and one switched 12.8 dB attenuator, all of which operate in a similar manner. Transformer T1 and the associated resistors form the first resistive ratio attenuator which is controlled from latch IC4a by means of the four f.e.t. switches comprising IC2. Attenuation is by the high-precision divider R37 and R40 with adjustment provided by R39 - range of control is limited by R38. To select the attenuator, IC4a Q(L) output goes low to switch IC2d off and IC2b on. IC4a Q output is taken on the G1 OUT line to inform AD2 of attenuator selection.

102. Three 25.6 dB amplifiers and a switched 12.8/13.56 dB amplifier complement the attenuators. Each of the first three amplifying stages is configured similarly. The first stage comprises TR10 and TR11 which form a series/shunt feedback pair and have additional components C13,R52 in the feedback line to reduce the bandwidth and so aid noise suppression. Amplifier output is buffered by emitter follower TR12 to prevent loading effects on the following attenuator. TR13 is the level detector amplifier whose output is clamped by D10,D12 and buffered by TR14. The 12.8 dB amplifier consists of feedback pair TR33 and TR34 whose gain is switched by TR32 to provide an additional 0.76 dB when required.

Logarithmic operation

103. Log amp conversion period is 10 µs. Conversion starts with the 1 µs RESET 1-3 pulse which switches on TR8 to charge the first three hold capacitors. For the next µs the capacitors discharge (to their previous levels for a steady signal) after which the rising edge of the CLOCK 1-3 pulse clocks out the attenuator selection setting for the first three D-latches. The fourth stage has separate clock and reset lines since it finds its correct operating state later in the conversion cycle. The D-latch Q outputs indicating attenuator selection are fed out on the G1,G2,G3,G4 OUT lines to AD2 and then latched ready to be added to the logged output of the detector.

104. For a signal increasing in amplitude from zero, the fourth stage 12.8 dB attenuator is first activated followed by the third stage 25.6 dB attenuator. The fall in signal level due to the operation of the third stage attenuator is sensed by the fourth stage comparator and the 12.8 dB attenuator then switches out. Attenuation insertion continues in the sequence shown in Table 2 until at maximum signal level all the attenuators are inserted and up to 12.8 dB of signal is fed out to the sampling gate. To ensure that the attenuator selection sequence operates in reverse for a falling signal level, the first and second latches' Q(L) outputs provide the set inputs for each succeeding stage. Thus an attenuator in one of the first three stages cannot be deactivated before that in the preceding stage.

Linear operation

105. For linear, voltage, measurements the clock inputs to the latches are overridden by the set and reset inputs. These preset the attenuation and amplification according to range. When settings of LIN 1,2,10,20 etc., are selected, reset is asserted which inserts all attenuators except the first thus providing an overall gain of 25.6 dB. When settings of LIN 5,50 etc., are selected, set is asserted which inserts all the 25.6 dB attenuators and switches out the 12.8 dB attenuator as well as switching on TR32 to increase the fourth stage amplifier gain. In this case, gain is set to 13.56 dB.

TABLE 2 ATTENUATOR SETTINGS - AD1

| | G1 (25.6) | G2 (25.6) | G3 (25.6) | G4 (12.8) | AMP (dB) |
|---|---|---|---|---|---|
| LOG | | | | | |
| | L | L | L | L | 89.6 |
| | L | L | L | H | 76.8 |
| | L | L | H | L | 64.0 |
| | L | L | H | H | 51.2 |
| | L | H | H | L | 38.4 |
| | L | H | H | H | 25.6 |
| | H | H | H | L | 12.8 |
| | H | H | H | H | 0 |
| LIN 1,2,10 etc. | | | | | |
| | L | H | H | H | 25.6 |
| LIN 5,50 etc. | | | | | |
| | H | H | H | L | 13.56 |

Output stages

106. To provide an output for frequency measurement purposes, the output signal is squared and shifted to t.t.l. levels by limiter IC13 and passed out on the IF COUNT OUTPUT line to AD2. The main signal path is to the mean level detector which is a precision rectifier type. It comprises high gain amplifier TR36 to TR38 with a full-wave diode rectifier D24,D25 in the feedback loop. The balanced output is fed through low-pass filters to remove the common mode r.f. signal and then via voltage followers IC14a and b to the balance to unbalance amplifier IC15. Thermistor R206 compensates for temperature effects while offset and gain are adjusted by R202 and R207 respectively. Here an output is taken to AD2 to provide LIN TRIG. This signal is also routed from AD2 to AR1 to provide an audio signal. Sample and hold IC16 samples the output 2 µs after the occurrence of the CLOCK 4 pulse to allow time for the data to settle. IC16 operation is controlled by the SAMPLE/HOLD line from AD2 and the output is connected to this board by the SAMPLED DATA line.

## Board AD2 - Log amplifier interface

Circuit diagrams : Chap. 7, Figs. 34 to 37

### General

107. This board and log amp board AD1 together form a system which converts the fourth i.f. analogue output of maximum 4 V p-p to a 13-bit data word. The board provides the synchronizing signals which enable the data to be displayed in either frequency or time in a number of ways. Frequency displays are the most often used and are selected when the FULL SPAN, /DIV or LOG buttons are pressed. Time display is selected when ZERO SPAN is pressed. Real zero span modes are only available on certain timebase ranges due to speed limitations in the data conversion process. To cover the faster timebase settings a sampling process is used. As well as being configured to enable the various display modes to be implemented, the board incorporates the trigger circuit essential for the sampling modes. The functions performed by this board are summarized as follows :-

(1) Trigger selection
(2) Data conversion
(3) Zero span display modes :
  a) Sampled
  b) Sampled with overlays
  c) Real
(4) /div sweeps

Each of these functions is explained in turn.

### Trigger selection (Sheet 2)

108. User-selectable trigger sources are line (supply frequency), video or external. Auto triggering is also available so that in the absence of any of the above triggers the circuit will default to a 10 MHz trigger. Positive- or negative-edge triggering is also available as a shift function on the front panel. The video trigger is a detected signal from log amp AD1. The signal is obtained from either LOG TRIG at AD1's input or LIN TRIG at AD1's output. The maximum frequency of this signal, limited by the i.f. bandwidth, is around 300 kHz, while loop time constants limit the lowest frequency to about 10 Hz. These frequency limits are extended by large amplitude signals. Since the external signal follows the same path as the video signal it has the same frequency constraints. Amplitude of mid-band triggering is 40 mV p-p and allows triggering to any signal which is 20 dB from the top of the screen.

109. Microprocessor controlled latch IC24 latches out trigger mode selection data from the quiet data bus on the occurrence of a rising edge on chip select line CS50. When either of the two LOG/LIN latch outputs is taken low by the processor, IC1a selects the LOG TRIG input, otherwise the LIN TRIG input is selected. LIN TRIG also provides the AUDIO signal to the rear panel volume control. The selected input, in the range 10 Hz to 300 kHz, provides the VIDEO TRIG input to a second selector. When latch IC24 takes VIDEO or EXT low, either the VIDEO TRIG or the EXT TRIG input is respectively selected. For the latter input, overload protection is supplied by clamping diodes D1,D6 and D2,D8 on the gate of source follower TR1.

110. The selected signal is a.c. coupled to input amplifier IC4a and fed in parallel to a Schmitt trigger and to a centring amplifier. The variable hysteresis Schmitt trigger consists of Schmitt IC5 and amplifiers IC4c and

IC4d which respectively supply IC5 with positive and negative power. References for the amplifiers are set by the sum of the voltages from potential dividers and peak detectors D3 and D4. The dividers ensure that for no signal input the amplifiers supply ±3 V in order to maintain IC5 operation. Since IC5 has positive feedback, its output switches between the positive and negative levels of the supplied power. IC4 and IC5 thus enable the Schmitt window to be controlled so as to be small for low level signals and as large as possible for high level signals.

111. The signal path to IC5 is via centring amplifier IC4b. Its purpose is to convert an asymmetrical input to a symmetrical output suitable for triggering purposes. This is needed because of the effect of a.c. coupling on non-unity mark/space ratio signals. To do this, half the sum of the voltages from the peak detectors is applied to the non-inverting input of differential amplifier IC4b, while the incoming signal is applied to the inverting input. Thus for an input on pin 6 varying between +5 V and -2 V, +1.5 V is applied to pin 5 and the output varies by ±3.5 V. IC5 output is converted to t.t.l. by driver TR2 before being applied as one of the three trigger signals to selector IC2. D5 protects against reverse bias breakdown.

112. Triggering detector IC6 is a retriggerable monostable which detects when the VIDEO or EXT TRIG signal has failed. Its pulse duration is set by R37, C64 so that providing the triggering rate does not fall below 10 Hz its pin 8 is held continuously high to pin 2 of trigger selector IC2. In this condition, IC2 allows trigger selection in the normal way (which also applies if AUTO is unasserted high to pin 2). But if the triggering signal fails and AUTO has been selected, IC2 pin 2 is taken low. Trigger selection then defaults to the 10 MHz input in order to maintain the trace.

113. IC2 is a dual 4 line to 1 line multiplexer configured to select 2 out of 3 trigger sources. The sources are; VIDEO TRIG/EXT TRIG from TR2, LINE TRIGGER from AR1 (both signals are available normal or inverted) and 10 MHz derived from the 50 MHz crystal oscillator on AC1. IC2 is controlled by latch IC24 using the AUTO and +ve lines to select two outputs (see Table 3). One of the two is then chosen by quad NAND gate IC3 to supply the TRIG signal used for data synchronizing. IC24 also controls IC3 so that when, for example, LINE is asserted low the supply frequency supplies the TRIG.

TABLE 3 TRIGGER MODE SELECTOR IC2 - AD2

| Selection Logic | | Input Selected | Outputs | |
|---|---|---|---|---|
| A | B | | 1Y | 2Y |
| L | L | C0 | 10 MHz | LINE |
| H | L | C1 | 10 MHz | $\overline{\text{LINE}}$ |
| L | H | C2 | VIDEO/EXT | LINE |
| H | H | C3 | $\overline{\text{VIDEO/EXT}}$ | $\overline{\text{LINE}}$ |

Data conversion (Sheet 1)

114. Data conversion involves both AD1 which supplies the level data in analogue and digital form and this board which provides overall control of AD1 operation, data conversion and the display mode. AD1 performs as a very accurate 4-stage switched gain amplifier supplying an analogue input of up to 12.8 dB and a 4-bit word giving the amount of inserted attenuation (and hence of amplification) as three amounts of 25.6 dB and one of 12.8 dB. A/D conversion of the analogue input to AD2 provides an 11-bit word which is then used to address a memory array held in two EPROMs. Here the data is split into two fields, one log and one linear. In the log case where the output code is logarithmic, it is added without error to the 4-bit word representing the four gain blocks. In the linear case AD1 gain is preset and therefore is not added. With all input data now in a digital form it undergoes parallel to serial conversion before being synchronously clocked out to the upper unit.

115. An analogue signal present at the input of log amp AD1 will after 3 conversions, each taking 10 µs, appear in the input of the display unit. The three stages are as follows :-

a) Set up AD1 switched gain amplifier
b) Convert last 12.8 dB of analogue signal to an 11-bit word.
c) Serially clock out 23-bits of data at 2.5 MHz.

All three stages of conversion rely upon sequence generator IC9 which is a 10-line decoder whose outputs are taken low in sequence for 1 µs. All three stages of data conversion run simultaneously.

Setting up AD1 switched gain amplifier

116. The sequence of operations performed by AD1 (detailed under the board heading) is controlled by the sequence of 10 pulses generated by IC9 on AD2 (see Fig. 6). When pulse 1 is generated, the three 25.6 dB detectors are reset following which pulse 2 autoranges the first three amplifiers and the attenuator settings are sent to AD2 on the G1 to G3 lines. Pulse 3 supplies a 1 µs delay to let the amplifier outputs settle and then pulse 4 resets the 12.8 dB detector. Pulse 5 sets the gain of the final amplifier and the attenuator setting is sent on the G4 line, after which pulses 6,7,8 and 9 provide a further 4 µs settling time. Pulses 10 and 1 hold the SAMPLE/HOLD line low giving the analogue output 2 µs in which to charge the hold capacitor. On AD2, the 4-bit word on lines G1 to G4 is converted to 3-bit binary by quad NAND gate IC16 (see Truth Table 4) and applied to bistable latch IC17. At this time the analogue input is connected on the SAMPLED DATA line to 12-bit A/D converter IC12.

A/D conversion

117. When IC9 pin 1 goes low it produces the SEQUENCE START pulse which performs several functions: it is taken via IC56a to provide the second half of the 2 µs SAMPLE/HOLD signal in order to continue the AD1 analogue sampling process; it is inverted by IC51a and used to enable latch IC17 to accept the AD1 attenuator setting data; and it provides the CONVERSION START pulse for A/D converter IC12. When pulse 1 returns high it latches out the IC17 3-bit word while the analogue signal, held on AD1, is asynchronously converted to an 11-bit word by IC12 for the next 6 µs.

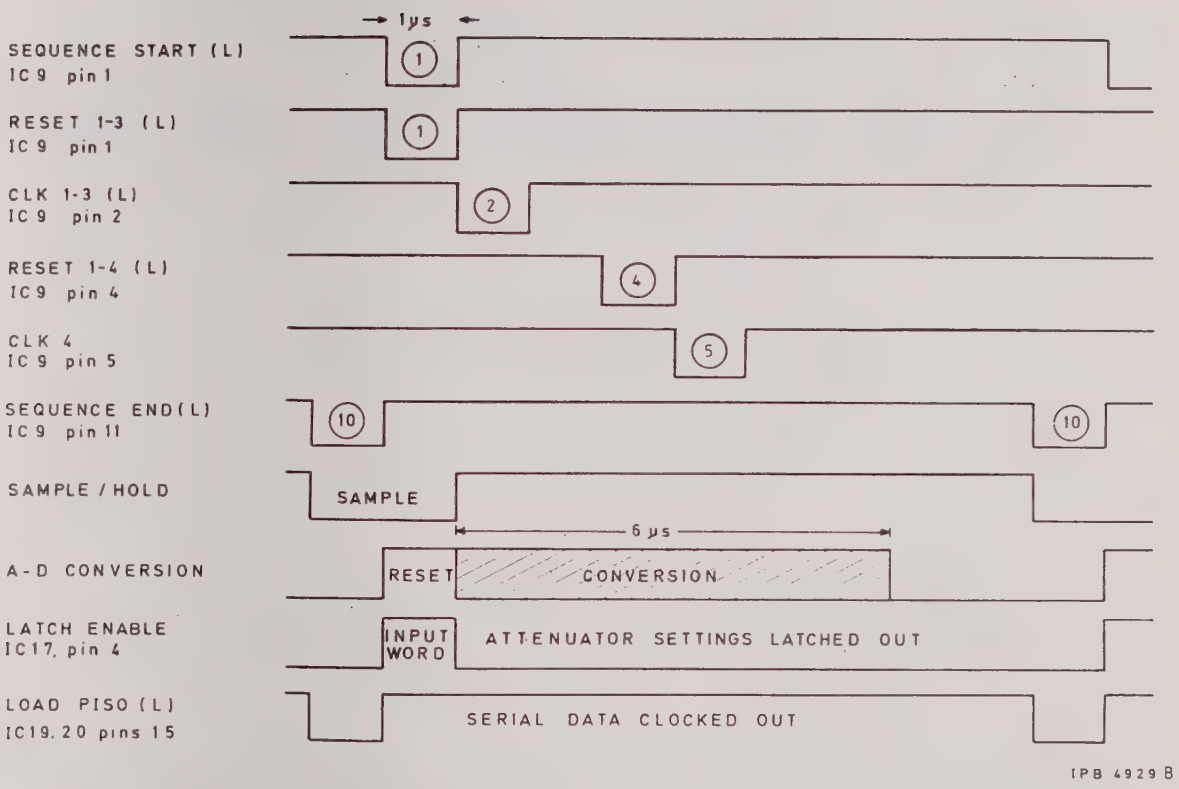


Fig. 6 Conversion waveforms - AD2.

118. The purpose of IC8a is to detect an analogue overload condition occurring when SAMPLED DATA exceeds 5 V. When this occurs, the 12 output bits from A-D IC12 change from 0111 1111 1111 to 1000 0000 0000. But since bit 1 is ignored and only 11 bits are passed on to provide data for the display, the system reads a transition from all '1's to all '0's. The top of screen analogue value is 4 V and when the above transition occurs, unless corrective action is taken, the display top edge would appear to drop by the equivalent of 4 V. To prevent this, the 5 V overload is detected by IC8a so as to cause bits 2 to 11 to be clamped at all '1's. IC8a does this by its data input on pin 2, provided by the A-D bit 1 output, being clocked out on the rising edge of the inverted SEQUENCE END pulse. IC12 pin 21 is then taken high to start conversion upon which the internal approximation register

takes all the output bits initially high. Since the conversion process, initiated by SEQUENCE END, has occurred 1 µs earlier than normal - during the period reserved for data conversion - bits 2 to 11, now all high are accepted as the corrected output for the display.

TABLE 4 4-INPUT TO BINARY CONVERSION - AD2

| Input lines | | | | IC16 pins | | | | IC17 pins | | |
|---|---|---|---|---|---|---|---|---|---|---|
| G1 | G2 | G3 | G4 | 8 | 11 | 6 | 3 | 6 | 3 | 2 |
| L | L | L | L | H | H | H | L | L | L | L |
| L | L | L | H | H | H | H | L | L | L | H |
| L | L | H | L | H | L | H | H | L | H | L |
| L | L | H | H | H | L | H | H | L | H | H |
| L | H | H | L | L | H | H | L | H | L | L |
| L | H | H | H | L | H | H | L | H | L | H |
| H | H | H | L | L | H | L | H | H | H | L |
| H | H | H | H | L | H | L | H | H | H | H |

119. At the end of the A/D conversion period, the resulting 11-bit word is used as an address to access two locations in the 20 dB range log law/linear look-up table held in EPROMs IC14 and IC15. Which of the two locations provides the output is determined by the logic level of the LOG/LIN line. For log operation LOG/LIN is held high, and when the SEQUENCE END pulse is generated the EPROMs output their data in logarithmic form. The high LOG/LIN signal also opens gates IC23 to allow the attenuator selection logic data to be summed with that from the EPROMs in the digital summer formed by IC18,IC21 and IC22. For linear operation the LOG/LIN line is low which causes the EPROMs to output their data in linear form and also closes gates IC23 since the attenuators are preset for this mode (see AD1) and the data is not required. An additional input to the summer is from the IP IDENT line which compensates for the loss in level caused by the 5 dB inserted in the r.f. path when checking for intermodulation products. The data is applied from the summer to two 8-bit shift registers IC19 and IC20 which are parallel in, serial out (PISO) registers. These load the data when pins 15 are taken low by the SEQUENCE END pulse.

Serial output data

120. The low SEQUENCE END pulse which caused the data to be loaded into the PISOs is also used to reset IC13b. This IC has its Q(L) output connected to its D input so that it divides the 5 MHz output from IC10 by 2 to supply the 2.5 MHz clock for the PISOs. The clock stops for 800 ns until the next 1 MHz

clock pulse from IC10 removes the IC13b reset. When the 2.5 MHz clock restarts, it is synchronized to the 800 ns pulse providing the SERIAL DATA SYNC signal, and the 23-bit word representing the detected fourth i.f. is clocked out from the PISOs to the display unit on the SERIAL DATA OUT line.

Zero span (Sheets 3 & 4)

121. In zero span, the horizontal axis of the display is graduated in time instead of frequency, and produces an oscilloscope-type display rather than the usual spectral lines. The maximum i.f. bandwidth of 1 MHz determines the maximum resolvable modulation frequency resulting in a fastest timebase setting of 5 µs/div. Relating this to the 500 vertical lines (ordinates) of resolution on the display means that minimum ordinate separation is 100 ns. This however, cannot be used for the display of real time signals since the fastest conversion rate in zero span mode is limited by the display unit input board to 200 µs/ordinate. Thus only for sweeps of 10 ms/div (1 division = 50 ordinates i.e. one tenth of the screen) or greater, can real time analysis take place. For faster sweeps a sampling technique is used which itself has two modes of operation, sampled and sampled with overlays. These modes are distinguished by the number of ordinates per trigger that are transmitted to the display. In sampled mode, one ordinate per trigger is transmitted. In sampled with overlays mode, between 5 and 250 ordinates per trigger are transmitted resulting in the picture being updated in bands rather than sequentially as in sampled mode. Zero span modes with associated timebases are as follows :-

| ZERO SPAN MODE | TIME BASE/DIV RANGE |
|---|---|
| Sampled | 5 µs - 50 µs |
| Sampled with overlays | 100 µs - 5 ms |
| Real | 10 ms - 20 s |

Zero span operation is summarized in Fig. 7 while the parameters for each of the 3 modes are given in Table 5.

Sampled zero span

122. The principle behind this mode is that the modulation being viewed is periodic and that an accurate trigger pulse is generated to predetermine a fixed point on the waveform. Just as in sampling oscilloscope technology, this mode uses the trigger to send the first sample of data and then re-triggers a short time later but adds a delay before sending the second sample of data. The delay is equal to one ordinate on the screen (i.e. 1/50th of the timebase). This delay increases by one ordinate period per trigger until 503 delays have accumulated beyond the trigger point. It is now that the display store is full and the whole sequence can be repeated.

Sampled zero span with overlays

123. In this mode, the display unit is configured to accept from the r.f. unit both real and sampled signals occurring in an interleaved fashion. Due to this, two data samples transmitted sequentially between units will not appear adjacently on the display. As an example, it might be required to display one cycle of a 1 kHz sinewave. Since its period is 1 ms and there are 10 divisions a time base of 100 µs/div is selected. And since the fastest conversion rate is 200 µs/ordinate, after the trigger point 5 samples of data are allowed to transfer between units before another trigger is requested. Sample 1 is transferred to ordinate 1 but samples 2,3,4 and 5 are transferred to ordinates 101,201,301 and 401 respectively. In order to fill in the gaps between these samples a delay of 1 ordinate is introduced and samples 6,7,8,9 and 10 are transferred to ordinates 2,102,202,302 and 402. This process occurs 100 times to form a fully overlayed display produced by 100 triggers with 5 samples per trigger.

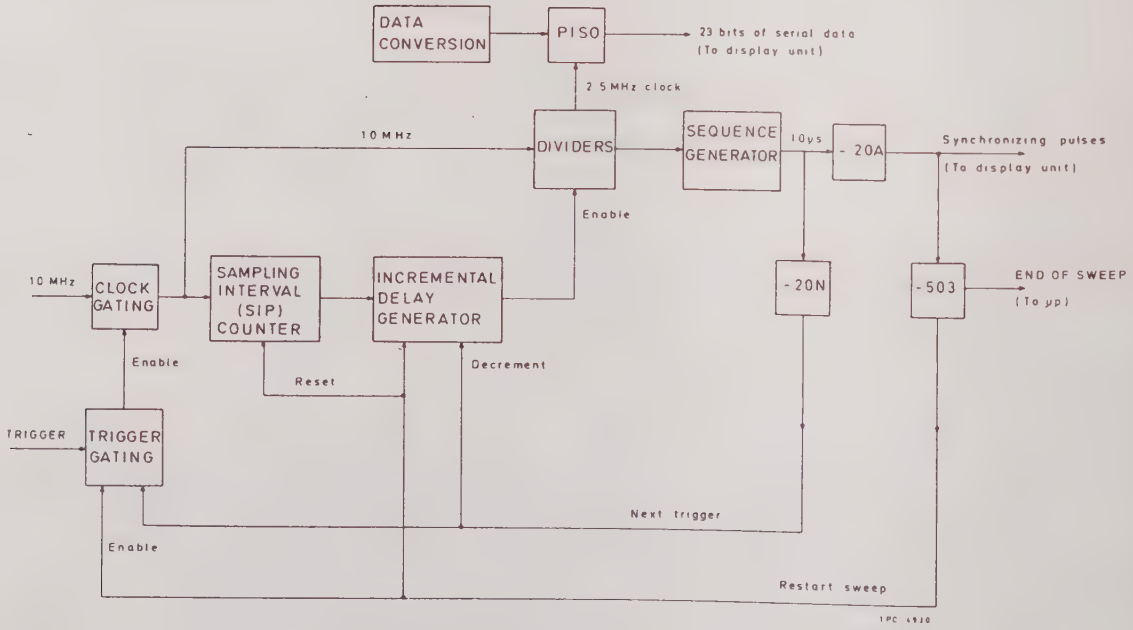


Fig. 7 Zero span operation summary - AD2.

TABLE 5 ZERO SPAN SAMPLING - AD2

| Time/div | SIP counter ratio | Overlay increment | Triggers | Division ratios | | Ordinate separation | Mode |
|---|---|---|---|---|---|---|---|
| | | | | A | N | | |
| 20 s | - | - | 1 | 2000 | 1 | 400 ms | REAL |
| 10 s | - | - | 1 | 1000 | 1 | 200 ms | |
| 5 s | - | - | 1 | 500 | 1 | 100 ms | |
| 2 s | - | - | 1 | 200 | 1 | 40 ms | |
| 1 s | - | - | 1 | 100 | 1 | 20 ms | |
| 500 ms | - | - | 1 | 50 | 1 | 10 ms | |
| 200 ms | - | - | 1 | 20 | 1 | 4 ms | |
| 100 ms | - | - | 1 | 10 | 1 | 2 ms | |
| 50 ms | - | - | 1 | 5 | 1 | 1 ms | |
| 20 ms | - | - | 1 | 2 | 1 | 400 µs | |
| 10 ms | - | - | 1 | 1 | 1 | 200 µs | |
| 5 ms | 1000 | 100 µs | 2 | 1 | 250 | 200 µs | SAMPLED WITH OVERLAYS |
| 2 ms | 400 | 40 µs | 5 | 1 | 100 | 200 µs | |
| 1 ms | 200 | 20 µs | 10 | 1 | 50 | 200 µs | |
| 500 µS | 100 | 10 µs | 20 | 1 | 25 | 200 µs | |
| 200 µs | 40 | 4 µs | 50 | 1 | 10 | 200 µs | |
| 100 µs | 20 | 2 µs | 100 | 1 | 5 | 200 µs | |
| 50 µs | 10 | 1 µs | 500 | 1 | 1 | 200 µs | SAMPLED |
| 20 µs | 4 | 400 ns | 500 | 1 | 1 | 200 µs | |
| 10 µs | 2 | 200 ns | 500 | 1 | 1 | 200 µs | |
| 5 µs | 1 | 100 ns | 500 | 1 | 1 | 200 µs | |

Real zero span

124. For real mode, the slower timebases of 10 ms/div to 20 s/div are available giving date conversion longer to process the information. In this mode data is transferred at the ordinate rate. For the fastest timebase of 10 ms/div ordinate separation is 200 µs for the 500 ordinates so that the transfer rate is 5 kHz. In the case of the slowest timebase of 20 s/div the data transfer rate is reduced to 2.5 Hz.

/DIV frequency sweeps

125. The sweep times available for this mode are the same as for real zero span. In this mode however, the data is transferred at 10 µs intervals each time accompanied by a synchronizing pulse. For the fastest timebase of 10 ms/div, ordinate separation is maintained at 200 µs but the upper unit performs averaging processes on adjacent data before displaying the amplitude information for each ordinate.

## Serial data sync pulse generation

### Circuit summary

126. The various zero span and frequency sweep display modes are determined by the circuit producing the serial data sync pulses since only when the data from the PISOs is accompanied by a sync pulse is it accepted by the display unit for display. The circuit may be divided into 5 functional areas :-

(1) Microprocessor control via IC47 and latch IC36 : The various counter sections of IC47 perform the following functions :- ÷100 generates the 100 µs CLOCK which provides the INT 7.5 signal to the processor; ÷20 A generates SERIAL DATA SYNC pulses at multiples of 200 µs; ÷20 N increments the delays between SERIAL DATA SYNC pulses; ÷503 generates END OF SWEEP pulses at the conclusion of each screenful of information. Latch IC36 asserts the control signals which define the mode of operation.

(2) Sequence start/stop by latches IC30 to IC32 : When required, the latches and associated gates interrupt the clock pulses to the sampling interval programmable counter and the sampling incremental delay generator until the occurrence of the next TRIG pulse.

(3) Sampling interval control via up counters ICs 33 to 35 and latch IC37 : The sampling interval programmable counter is preset by processor data mainly from latch IC37 with the 2 least significant bits from IC36. The preset defines the unit of delay, multiples of which are counted by (2) above to introduce a delay between the generation of one SERIAL DATA SYNC pulse and the next.

(4) Incrementing sampling intervals by up counters ICs 40 to 42 and down counters ICs 43 to 45 : The sampling incremental delay generator is clocked by the sampling interval programmable counter. The down counters provide an incrementing preset for the up counters so that SERIAL DATA SYNC pulses are generated after an increasing delay (e.g. if the delay from (3) above is 200 ns and the counter is sequentially decremented from 0 to 3 the interval between sync pulses is respectively increased by 200, 400 and 600 ns).

(5) Sequence generator IC9 and counter ICs10 & 11 : Operating details with respect to data output are given earlier. In the present context, the output from (4) above is used to enable the counters after an appropriate delay. The counter clocks the sequence generator whose every 10th pulse supplies SERIAL DATA SYNC pulses either directly at 10 µs intervals or at multiples of 200 µs.

### Operation

#### Sampled mode

127. The simplest form of operation is zero span sampled mode in which IC9 generates a sequence of 10 negative-going 1 µs pulses with every 10th pulse counted by the ÷20 A and ÷20 N counter sections of IC47, and with every 7th pulse in the sequence clocking D-latch IC46b. In sampled mode, ratios A and N are both set to 1 so that whenever a SERIAL DATA SYNC pulse is transmitted to the display unit, the Q output of IC46b is set and serial data transfer takes place at the output of the PISOs. The sequence is terminated 7 µs later when the 7th pulse from the sequence generator clocks IC46b.

128. The rising edge of the 7th pulse clocks IC46b Q output low to assert DISABLE 10 MHz CLOCK while the Q(L) output removes DISABLE PROGRAMMABLE COUNTERS. The latter signal removes the reset to IC31b controlling the enable signal for the two sets of up counters IC33 to IC35 and IC40 to IC42, while DISABLE 10 MHz affects a number of D-latches. It clocks IC31a which resets IC30a which, in turn, resets IC30b to close gate IC53b. The gate halts the GATED 10 MHz clock to the sequence generator and to the first set of up counters. Having been reset, IC30a automatically reboots itself when its Q output goes low, by setting IC30a so that the reset is removed. IC30a Q output also resets latch IC46a which removes ENABLE DATA CONVERSION to counters IC11 causing them to reset to zero ready for a new sequence.

129. At this stage both sets of counters are disabled along with the GATED 10 MHz clock and the circuit is waiting for the next TRIG input to restart the sequence. In this, the simplest form of operation, ICs 33 to 35 are programmed to divide by 1,2,4 or 10 (depending upon timebase) while the number of previous triggers is recorded as an accumulated count in ICs 40 to 42. IC30b has been reset; its purpose is to provide a delay to ensure that the first GATED 10 MHz pulse does not reach the first set of up counters before they are enabled. If this were to happen, incorrect loading on terminal count would occur.

130. When TRIG is received from the trigger circuit it clocks IC30a which in turn clocks IC31b to assert ENABLE DIVIDERS to both sets of counters, as well as removing the resets to both IC46a, controlling the counter input to the sequence generator, and IC30b. Assuming that the sampling interval programmable counter has all 1s on its inputs (to divide by 1) then when the enable goes high a ripple carry will cascade through to pin 2 of IC53c to open the gate. Latch IC30b is now enabled to respond to the 10 MHz clock input by opening NAND gate IC53b. The resulting GATED 10 MHz clock signal commences on a falling edge which ensures that the first set of up counters is not clocked by the rising edge until at least 50 ns (i.e. half a clock period) after they have been enabled. The clock signal is gated through IC53c to provide the low RELOAD ON TERMINAL COUNT signal which allows the counters to reload, as well as providing the SAMPLING PERIOD CLOCK for the following sampling incremental delay generator. These counters count up to their maximum count upon which a ripple carry occurs taking pin 13 of IC53d high to gate through the next clock pulse. This clocks IC46a which asserts ENABLE DATA CONVERSION to enable counter ICs10 and 11. Sequence generator IC9 which drives all the data conversion circuits, then recommences operation. The net result of the above actions is to accurately define the time at which data conversion starts with respect to the trigger pulse and hence of the analogue signal to be displayed.

131. When 20 pulses have been counted from the sequence generator by the ÷20 A and ÷20 N sections of IC47 the former sends a SERIAL DATA SYNC pulse to the display unit while the latter sets IC46b. IC46b Q(L) output asserts DISABLE PROGRAMMABLE COUNTERS low resetting IC31b which removes ENABLE DIVIDERS and stops the counting operation of both sets of up counters. The Q output takes DISABLE 10 MHz CLOCK unasserted high which decrements down counters ICs 43 to 45 by 1 and also holds open gates IC53c and IC53d. The opened gates allow the 10 MHz clock signal to continue through in order to provide the RELOAD ON TERMINAL COUNT signal. This enables both sets of counters to reload; the sampling interval programmable counter loads the data latched from IC36 and IC37, while the sampling incremental delay generator loads the decremented count from the down counters. Thus with the generation of each sync pulse the latter counters load a decremented count. This means that each time, they require an extra SAMPLING PERIOD CLOCK pulse to cause the overflow which

re-enables the sequence generator. Since the clock period is defined by the sampling interval counter (in this case to 100, 200, 400 or 1000 ns) the sequence generator is re-enabled - and hence the sync pulse is generated - after an increasing delay.

132. When the display store is full, 503 sync pulses will have been transmitted and the ÷503 counter section of IC47 clocks D-latch IC32b. The Q(L) output going low asserts END OF SWEEP to AD3 and the processor. The Q output asserts DISARM TRIGGER high which, after inversion, enables the down counters to load with their initial count of all 1's (i.e. to maximum) and also takes IC52b pin 8 high as a preliminary to halting the sync pulse generation process. This happens when DISABLE 10 MHz CLOCK goes low which clocks IC31a and IC32a. IC31a halts the GATED 10 MHz counter clock signal in the manner previously described which stops the sequence generator. IC32a Q(L) output goes high to close gate IC54a to the TRIG input, while the low Q output resets the END OF SWEEP latch IC32b. The processor responds to END OF SWEEP (after a delay) by setting SWEEP ARM high from IC36. This signal to IC54b provides an additional TRIG inhibit, and to IC47 counter sections resets both the ÷20 N and ÷503 counters. Then the processor pulses REFRESH RETRACE low from IC36 which takes D-latch IC32a Q(L) output low to remove its TRIG inhibit. The ÷20 N and ÷503 counters as well as the TRIG input, are still inhibited by SWEEP ARM and when this signal is taken low, IC30a is ready to respond to the next TRIG pulse. The data present in the display unit will now appear on the display. When the next TRIG pulse appears it will cause the generation of the first of the 503 pulses synchronizing the transfer of the data used to form the next waveform to be displayed.

Sampled with overlays

133. For the sampled with overlays mode the circuit functions as for the sampled mode except that several samples are taken per trigger. This is defined by the division ratio N for the ÷20 N section of IC47. For example, for 100 µs/div N is set to 5 which means that IC46b is set coincident with every 5th SERIAL DATA SYNC pulse.

Real

134. In real mode, every valid sample of data is accompanied by a SERIAL DATA SYNC pulse and is displayed at the ordinate rate. To achieve this, A is adjusted according to timebase for the ÷20 A counter section of IC47. Thus for the 20 ms/div timebase, A is set to 2 so that SERIAL DATA SYNC pulse separation is 400 µs. Unlike for the other zero span modes the ÷20 N counter and the up counters play no important part, merely dividing by 20 and 1 respectively.

/DIV frequency sweeps

135. For /DIV mode the FREQ/ZERO SPAN line from IC36 is latched high. After inversion, this causes a low to be applied to pin 9 of NAND gate IC57c which then closes to prevent the ÷20 A counter from providing the SERIAL DATA SYNC pulses. The high applied to pin 1 of IC57a opens the gate to the output from the sequence generator so that SERIAL DATA SYNC pulses are generated at 10 µs intervals. Since many more samples will be received than can be displayed, the samples are averaged before being displayed at the ordinate rate. For the fastest timebase, where ordinate separation is 200 µs, 20 data samples are averaged before the result is displayed. As for zero span mode the up counters are ineffective.

## SYNTHESIZER

136. The frequency standard for the synthesizer is provided either internally from the 10 MHz temperature compensated crystal oscillator on AD4, or externally from a 1, 2, 5 or 10 MHz input to the EXT STD socket (see Fig. 8). Connection of an external standard automatically disables the internal one. The standard drives the sampling gate on AC6 to phase lock the 50 MHz varactor controlled crystal oscillator on AC1. VCXO output is taken to the calibrator on AE1 which supplies the STD 50 MHz OUTPUT socket on the instrument front panel. Oscillator output also feeds to the fourth mixer on AC2 as well as driving the sampling gate on AA10 to phase lock the third local oscillator. The main output at 50 MHz is taken to AB4 and AA8 and used to phase lock the l.f. master and YIG oscillators to the frequency standard when they are not being swept. VCXO output is divided to 10 MHz by AC6 to supply a trigger source for AD2 which provides the gating period for the frequency counter on AD38. Two further divided outputs from AC6 provide 5 MHz used by both the up and down mixers on AC4, and the tracking generator on AK13.

### YIG-tuned oscillator

137. Operating in the frequency range 4902 to 9102 MHz the YIG-tuned oscillator (YTO), unit AJ7, provides the first local oscillator for the receiver. For wide- and mid-range sweeps (5 MHz and above) the YTO itself is swept, driven by board AJ6. For narrow sweeps (2 MHz and below) the YTO is phase locked to a harmonic of the cavity oscillator which is then swept. Phase locking is achieved by the output from AA6 being used to drive the sampling gate on AJ4 after division by 2 in AJ5.

### Cavity oscillator

138. The cavity oscillator on AA6 generates a frequency in the range 518 to 548 MHz which is multiplied in the AJ block to determine the 1st l.o. frequency in narrow sweep spans. It is offset locked to the translation oscillator by the input to the mixer on AA6 and compared for phase by AA8 with a divided input from the 50 MHz VCXO on AC1. Output to the YTO sampling gate is also fed to AA12 for division by 16 to provide a frequency capable of being measured by the counter on AD38. To enable the counter to measure the frequency of the YTO on wide sweep spans when it is free-running, the cavity oscillator is tuned until its harmonic is phase locked to a the YTO frequency. Since the frequency relationship between the two oscillators is known, the YTO frequency can be calculated.

### Translation oscillator

139. The translation oscillator on AA5 provides the means by which the l.f. synthesizer can control the cavity oscillator and, ultimately, the YTO providing the 1st l.o. AA5 generates a signal between 553 and 558 MHz. It is phase locked by AA7 to the input from the 550 MHz oscillator on AA9 applied to the mixer on AA4, and the divided input from AB5. The loop adds the sweeps produced by the l.f. synthesizer to the translation oscillator.

### LF master oscillator

140. LF master oscillator AB3 covers the frequency range 26.9 to 34.1 MHz and can be swept for spans of 50 kHz to 2 MHz. It is phase locked to the frequency standard by the sampling gate on AB4. Driven by the divided output from AC1, it enables the oscillator to be locked at 100 kHz intervals over the

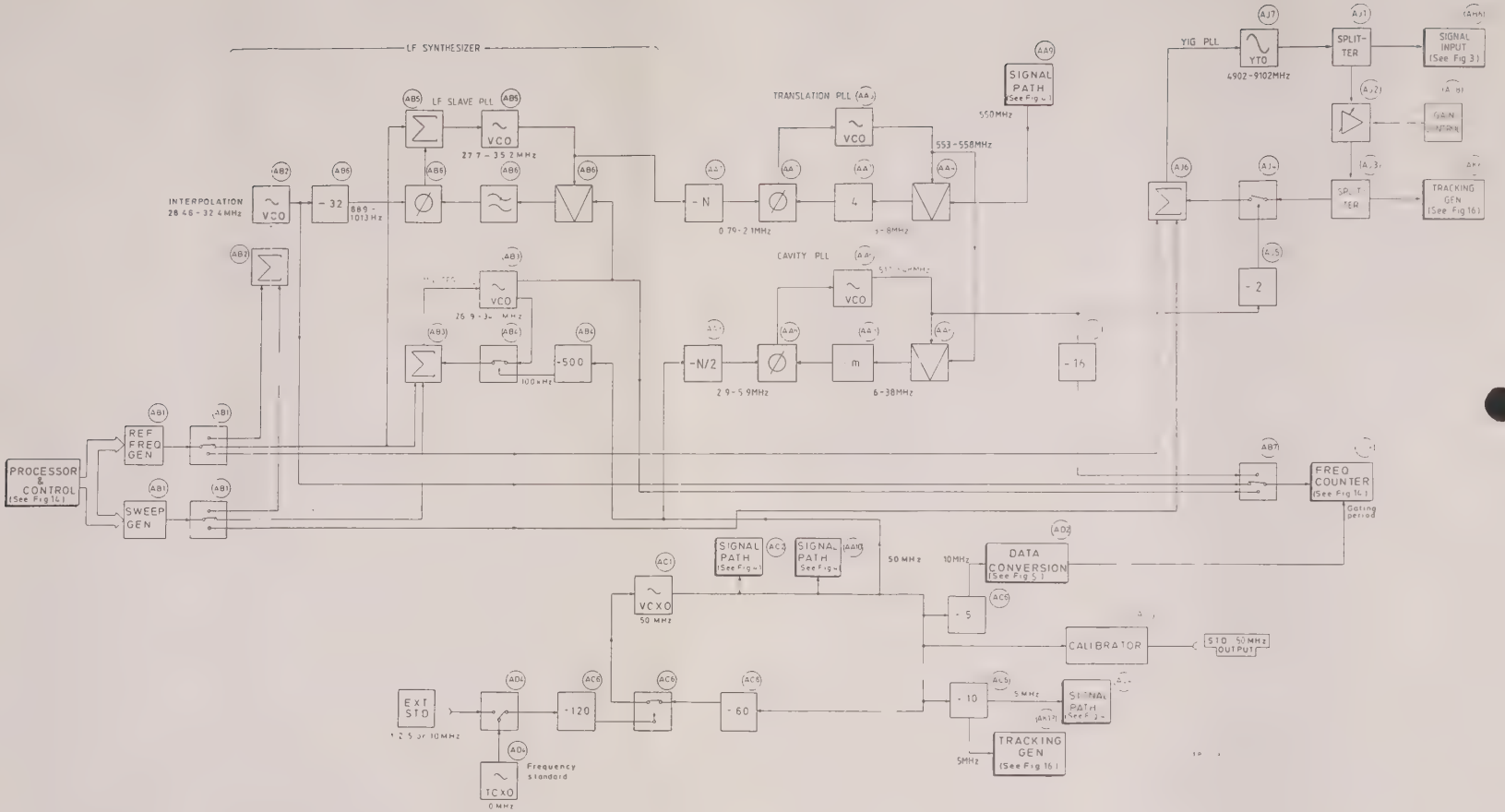


Fig. 8 Synthesizer block diagram showing main functions of boards.

band 26 kHz to 34 MHz. Frequency setting and sweeping voltages from AB1 are summed with the phase correction voltage in AB3. Oscillator output, which is counted directly to monitor its frequency, feeds to the mixer on AB6.

LF slave oscillator

141. Output from the l.f. master oscillator on AB3 is mixed in AB6 with the output from the l.f. slave oscillator on AB5 and the difference frequency is compared for phase with the divided output from the interpolation oscillator on AB2. Any difference in phase causes an error voltage to be generated which adjusts the frequency of the varactor controlled l.f. slave. The l.f. slave is thus permanently phase locked to the sum of the l.f. master frequency and the interpolation oscillator frequency divided by 32.

Interpolation oscillator

142. The free-running interpolation oscillator on AB2 forms a third master oscillator and covers the range 28.46 to 32.4 MHz. Output is divided by 32 in AB6 to give an operational range of 124 kHz and an offset frequency of 889 kHz. The oscillator is swept for spans of 100 Hz to 20 kHz and can be set to a resolution of 1 Hz anywhere within the operational range. Frequency setting and sweep voltages from AB1 are summed in AB2. Because of the divider, the actual oscillator sweep range is 32 times greater than the selected span. By counting its output frequency before division, the divided output can be measured to 1 Hz in a counter gate time of 31.25 ms instead of the 1 second gate required for direct measurement of the output.

Frequency sweep settings

143. When a new frequency is entered on the keyboard, the frequency settings of the interpolation, l.f. master and YIG oscillators are each measured by means of the frequency counter on AD3. Computed reference frequency voltages are generated on AB1 and used to reset each oscillator, breaking phase lock as necessary. If the oscillator is to be phase locked, the voltage applied is just enough to pull the oscillator within loop acquisition range. Either one or both master and YIG oscillators may be phase locked; AB3 to 100 kHz increments, AJ6 according to sweep span. For frequency sweeping, a sawtooth voltage is generated on AB1 followed by attenuators which determine the sweep limits. To achieve the larger spans above 5 MHz the YIG oscillator is swept, using either the f.m. or main coil according to span. For spans of 2 MHz and below either the l.f. master or the interpolation oscillator is swept, with the YTO in harmonic lock. For the smaller spans of 2 kHz and below an additional attenuator, on AB2, reduces the sweep by a factor of 10. Oscillator and attenuator settings for the various sweep spans are shown in Table 6.

TABLE 6 FREQUENCY SWEEP SETTINGS

| Sweep span | Attenuation (AB1) | Attenuation (AB2) | Interp. osc (AB2) | LF master osc (AB3) | FM coil YTO (AJ6) | Main coil YTO (AJ6) |
|---|---|---|---|---|---|---|
| FULL<br>4200 MHZ<br>2000 MHz<br>1000 MHz<br>500 MHz<br>200 MHz<br>100 MHz | x1<br>x1<br>x2<br>x4<br>x8<br>x20<br>x40 | | Tune<br>28.8<br>MHz | Tune<br>30.5<br>MHz | Ground | Sweep<br>&<br>Ref |
| 50 MHz<br>20 MHz<br>10 MHz<br>5 MHz | x2<br>x5<br>x10<br>x20 | | Tune<br>28.8<br>MHz | Tune<br>30.5<br>MHz | Swept | Slug<br>&<br>Ref |
| 2 MHz<br>1 MHZ<br>500 kHz<br>200 kHz<br>100 kHz<br>50 kHz | x1<br>x2<br>x4<br>x10<br>x20<br>x40 | | Tune<br>28.8<br>MHz | Sweep<br>&<br>Ref | Locked | Hold in |
| 20 kHz<br>10 kHz<br>5 kHz<br>2 kHz<br>1 kHz<br>500 Hz<br>200 Hz<br>100 Hz | x1<br>x2<br>x4<br>x1<br>x2<br>x4<br>x10<br>x20 | x1<br>x1<br>x1<br>x10<br>x10<br>x10<br>x10<br>x10 | Sweep<br>&<br>Ref | Locked<br>on<br>100 kHz<br>tooth | Locked | Hold in |

## Board AA4 - 550 MHz buffer

Circuit diagram : Chap. 7, Fig. 3

144. The 550 MHz signal from third l.o. board AA9 arrives on the board at a level of +2 dBm and is then split into two signal paths using power splitter T1,T2. The power splitter has a 3 dB loss between input and output ports. This provides two outputs, each through a 3 dB pad and a two-stage buffer amplifier. Each amplifier is a high isolation buffer which provides a gain of 10 dB and has a reverse isolation of 50 dB. Outputs at +7 dBm are from TR1,TR2 to second l.o. divider board AH8 and from TR3,TR4 to translation loop mixer board AA4a.

## Board AA4a - Translation loop mixer

Circuit diagram : Chap. 7, Fig. 3

145. The 553 to 558 MHz signal from translation oscillator board AA5 enters the at a level of -5 dBm. It is amplified to 0 dB by single-stage buffer amplifier TR1 and provides the signal for the r.f. input port of mixer X1. The 550 MHz signal from buffer board AA4 enters the board at a level of +7 dBm and is attenuated 10 dB by R8,R9,R10. It is passed to the two stage buffer formed by TR2 and TR3 which provides 10 dB forward gain and 50 dB of reverse isolation. The signal is then used to drive the l.o. port of the mixer at a level of +7 dBm. The resulting lower sideband product in the range 3 to 8 MHz is fed out to translation loop board AA7 at 200 mV p-p.

## Board AA5 - Translation oscillator

Circuit diagram : Chap. 7, Fig. 4

146. Translation oscillator board AA5 generates a signal between 553 and 558 MHz. The signal is phase locked to the divided sum of the 550 MHz oscillator and the l.f. synthesizer, and provides the means by which the l.f. synthesizer can control the frequency of the cavity oscillator on board AA6a and ultimately of the first local oscillator.

147. VCO TR1 is a common-collector Clapp oscillator operating over the frequency range of 553 to 558 MHz. The tuned circuit consists of L3,C6,C7 and varactor diode D1. A control voltage on the VCO FREQUENCY CONTROL LINE from the phase detector on board AA7 is fed to the varactor diode and used to control the oscillator . Inductor L3 provides coarse adjustment of the oscillator centre frequency, while R6 provides fine adjustment of the frequency range.

148. The v.c.o. signal is taken off at TR1 emitter by a network formed by C11,R12,C12. TR2 is a single buffer stage which drives the power splitter consisting of T1 and T2. The splitter feeds a pair of high reverse isolation two-transistor amplifiers. Each amplifier has a gain of 10 dB and a reverse isolation of 60 dB. TR3,TR4 supply an output to translation loop mixer board AA4a while a second output, from TR5,TR6, is connected to cavity oscillator buffer board AA6.

## Board AA6 - Cavity oscillator buffer

Circuit diagram : Chap. 7, Fig. 5

### Input and buffers

149. Input at 517 to 548 MHz is from cavity oscillator board AA6a at 0 dBm. The signal is taken to the power splitter formed by T1,T2 where it splits into two paths. Each path has a resistive matching pad at its input to ensure that the following buffer has the correct input operating level. One of the paths, via the 2 dB pad formed by R27,R28,R29, leads to a second power splitter formed by T4,T5. Each of the power splitters on this board has a 3 dB loss between input and output ports. The two 10 dB gain buffer amplifiers which follow the splitter employ grounded emitter stages and have a reverse isolation of 60 dB. TR5,TR6 feeds to the first l.o. sampling gate board AJ5, while TR7,TR8 feeds to frequency counter divider board AA12.

### Mixer

150. The second input path from splitter T1,T2 is via the 5 dB pad formed by R10,R11,R12 to the 15 dB gain buffer amplifier TR2,TR3,TR4 which has a reverse isolation of 60 dB. Amplifier output at +7dBm supplies 517 to 548 MHz to the l.o. port of the double-balanced down mixer X1. The r.f. port of the mixer is supplied by a 553 to 558 MHz input from translation oscillator board AA5 at -5 dBm. This signal is buffered by the 5 dB gain single common emitter stage TR1 to feed the mixer at 0 dBm. The selected difference frequency of 6 to 38 MHz from the mixer is sent to AA8 and used in the cavity phase locked loop.

## Board AA6a - Cavity oscillator & Board AA6b - Cavity oscillator p.c.b.

Circuit diagram : Chap. 7, Fig. 4

151. The cavity oscillator generates the final output frequency from the u.h.f. synthesizer, which is then multiplied by the AJ block circuits to produce the receiver first local oscillator frequency. The oscillator is offset locked to the translation oscillator by the cavity phase locked loop, and operates in the frequency range of 518 to 548 MHz.

152. The cavity oscillator on board AA6a is basically a transmission line oscillator. The main tuning element is a brass rod, L4, of characteristic impedance 120 ohm and electrical length of one-tenth of a wavelength over the operating frequency range. The rod is mounted in a milled box, this gives constructional rigidity to minimise microphony and provides a low indictance earth.

153. The circuit is capacitively tuned at the non-earthy end of the rod. Mechanical tuning is by means of C5, a tuning screw with a PTFE dialectric sleeve which may be screwed in and out of a concentric hole in the end of the tuning rod. This provides the preset tuning for the cavity, a locknut holds the tuning screw in place. Electrical tuning is by means of varactor D1 in series with a mechanical capacitor C4. C4 is constructed from a metal bush separated from the rod by a PTFE insulated sleeve as dialectric. D1 tunes the cavity oscillator over its frequency range as reverse bias is varied from 3 V to 50 V. L3 provides a high impedance in the varactor drive line.

154. Output from the oscillator is via semi-rigid coaxial cable, with the inner conductor tapped directly onto the tuning rod close to its earthy end. Output level is determined by the coupling area of the conductor loop and is in the region of 0 to +3 dBm. The output at a frequency of 518 to 548 MHz is taken to cavity oscillator buffer AA6.

155. The primary circuit is maintained in oscillation by power mutually coupled into the main tuning rod by the single transistor circuit on board AA6b mounted just above the rod. Mutual coupling from the main tuning rod induces a current into the base of TR1. This current is a function of the track geometry from TR1 base through L1 and R2 to the emitter. Current gain in TR1 results in amplified current flowing in the collector loop of TR1. This sets up a field which is dependent on the track geometry between collector and emitter via L2, R1 and R2, and results in an amplified in-phase version of the pick-up field being mutually coupled back into the tuning rod. The positive feedback sustains oscillations at the frequency determined by the primary tuned circuit.

156. Amplifier d.c. conditions are determined by the +15 V rail and 14 mA current sink located on line cleaner board AA11. C1 and C2 on AA6b are d.c. blocking capacitors, and L1 and L2 are r.f. chokes which isolate the maintaining circuit from the d.c. supply.

## Board AA7 - Slave VCO

Circuit diagram : Chap. 7, Fig. 6

157. A 3 to 8 MHz signal from translation loop mixer board AA4a is connected to PLC2 at an amplitude of 200 mV p-p. This is amplified and buffered by TR4 and TR5 and fed to the t.t.l. driver formed by TR6,TR7 and TR8. Here the signal is switched and amplified to provide a t.t.l. compatible level for the divide by 4 circuit formed from dual D-type bistable IC5. The divided signal forms one input to the loop phase/frequency comparator IC6.

158. The second input to the comparator is the 27 to 35 MHz l.f. synthesizer signal at around 0 dBm (633 mV p-p) from AB5 on connector PLE. The signal is taken to the following t.t.l. driver formed by TR1 and TR2 and used to clock IC3 which is a 4-bit up/down counter set to count down. This counter is fed with division ratio data in two sequential 4-bit words by data selector IC2 which obtains its input from 8-bit latch IC1. Data word selection and counter loading are controlled by dual D-type bistable IC4. IC4b is configured to divide by 2 by having its Q(L) output connected to its data input. Together these four ICs form a divide-by-N programmable divider.

### Divide-by-N programmable divider

159. The data in the form of two adjacent 4-bit binary numbers comes from AB1 to AA7 on the 8 lines of the slow data bus, and is latched by slow select line CS1 onto the outputs of latch IC1. One of the two 4-bit data words appears at the output of data selector IC2, according to the state of the select line to IC2 pin 1. The 4 data lines load data into the down counter IC3 when LOAD pin 11 is taken low.

Divider operation

160. The sequence of operations in the divider is as follows and commences with the counter counting down (refer to Fig. 9): IC3 counts down from the previously loaded-in number until the terminal count of zero is reached, upon which the carry output CY on pin 12 goes high. This supplies the data input to IC4a, so that when this IC is clocked by the next positive-going edge the data is transferred as a low to the Q(L) output. The logical low provides the LOAD enabling signal to IC3 pin 11 and during this clock period the data on the A,B,C,D inputs is loaded into the counter. Also during this period, the counter is prevented from counting due to the LOAD input being held low by IC4a while, as a result of the loading, the terminal count on IC3 pin 12 returns low. On the next positive clock edge the counter LOAD input goes high as IC4a is clocked which also clocks IC4b. The output of this bistable changes state and selects the alternative 4-bit word which appears at counter inputs A,B,C,D (this has no effect on the counter until the next counter load cycle takes place). Now that the counter LOAD input is high, on the next positive clock edge the count previously loaded can be counted down. The count is decremented by one for every clock edge until the terminal count is reached, when the cycle described above repeats. Output from second bistable IC4a is therefore a pulse after every two input cycles to the programmable divider.

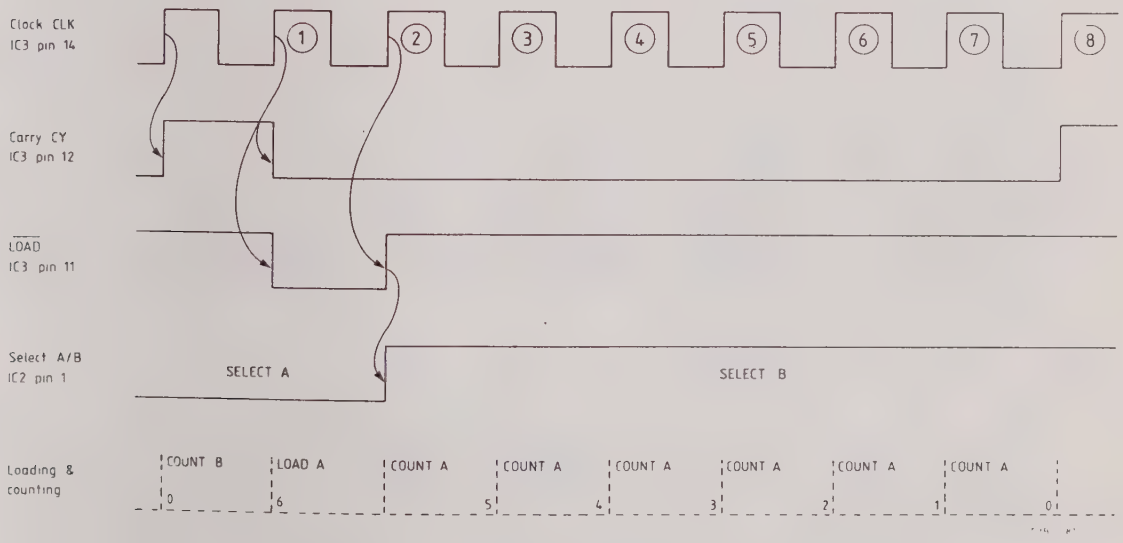


Fig. 9 Divide-by-N programmable divider operation - AA7,AA8.
Example showing count down from a loaded value of 6.

161. For any value of 4-bit word loaded into the counter, one output cycle is produced by input cycles which are two more than the number loaded into the counter, e.g. for a loaded number of 6, eight input (clock) cycles produce one output cycle (see the example in Fig. 9). Also, if the number loaded in the first cycle were 8 the second 4-bit word would have the value of 7, 8 or 9 (since the numbers must be the same or adjacent). Thus for the output at TP1 to be 19 times lower in frequency than the clock input to the programmable divider, N = 19 and the two words sequentially loaded into the programmable

divider would be the binary codes for 7 and 8 as follows:-

| D0 | D1 | D2 | D3 | D4 | D5 | D6 | D7 |
|---|---|---|---|---|---|---|---|
| 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 |

Note that the words may be loaded in any order. The divide-by-N output in the range 0.79 to 2.1 MHz is available at TP1.

Phase/frequency comparator

162. TTL levels from the dividers are converted to e.c.l. levels (0 and -5 V) by the networks R29,R30,C20 and R31,R32,C21 for the following comparator. The phase/frequency comparator is based on dual bistable IC6 and two gates of IC7. The comparator derives its name from the fact that it provides an output voltage proportional to the difference in phase between the signals at its inputs, over a range of ± 1 cycle, but still provides a voltage which pulls the oscillator into lock even when the two input signals differ in frequency. This is not the case with many types of phase detector, and means that the loop should never be able to become permanently unlocked.

Comparator operation

163. Operation is shown by the following example in which the upper bistable is leading the lower one in phase: The upper bistable is clocked by a positive-going edge first which takes its Q(H) output high. When the lower bistable is clocked later its Q(H) output also goes high. NOR-gate IC7a now detects that both Q(L) outputs are low and takes its output high. After a delay of 22 ns set by R34,C22 the high output from buffer IC7b resets both bistables whose Q(L) outputs then go low. The result is that the upper bistable's Q(H) output is high for a time equal to the delay between input pulses plus the reset time, while the lower bistable's Q(H) output is high only for the reset time. If the lower bistable is clocked first the output conditions are reversed. If the two inputs arrive in phase the delay circuit ensures that the resulting minimum pulse is of sufficient duration to maintain detector sensitivity.

Loop active filter

164. The phase detector output pulses are limited in bandwidth by resistor network R41 and capacitors C24,C25,C26,C27 and fed to the loop active filter/integrator IC8. A phase difference between phase detector inputs causes the integrator to slew in such a direction that the v.c.o. varactor control line (to AA5 translation oscillator) brings the oscillator into phase lock, with the two phase detector inputs in phase. At this point the integrator ceases to slew, and only moves slightly to correct for drift/noise in the oscillator. Components C28,C31,C48,R50 and C29,C30,C49,R49 (two complementary groups) set the phase locked loop bandwidth, which in this case is set for a natural frequency of around 150 kHz. The output is a negatively-going ramp which provides the AA5 v.c.o. search signal.

Search oscillator

165. The required operating range of the translation oscillator is 553 to 558 MHz, giving a 3 to 8 MHz difference frequency input to AA7 as discussed above. The oscillator itself has a potentially much wider frequency range than actually required however. If the oscillator varactor voltage were to be taken sufficiently low, perhaps by a supply transient, so that the

oscillator frequency came into the range 542 to 547 MHz, the difference frequency would be in the same range again. Now, however, the sense of the drive to the oscillator varactor line would be reversed, and if the difference frequency became larger than the phase detector reference frequency (1.f. synthesizer divided by N), the v.c.o. would be thrown lower still in frequency, the feedback would be positive, the system could not recover phase lock on its own and the v.c.o. varactor line would be driven to the lowest voltage possible.

166. To prevent this condition, a search oscillator has been incorporated based on IC9 which acts as a comparator. Its non-inverting input is normally held at a reference voltage of -7.5 V by potential divider R56,R57. If the loop gets into the unwanted state, the varactor line will be driven lower than this. The comparator output, which had been sitting close to the -15 V rail, shoots towards the +15 V rail, pulling the varactor line positive again, bringing the v.c.o. into the desired operating range. The non-inverting input of IC9 is also pulled up to the positive rail (D2 clamps its voltage to 0.7 V above the +15 V rail). C34 then charges through R55 so that the non-inverting input voltage gradually drops. When this voltage drops below that on the inverting input, the comparator output drops toward the negative rail again. Diode D1 turns off, insulating the loop filter/integrator from the comparator. The integrator output voltage drops steadily until the correct varactor voltage for phase lock is reached, when the loop drops back into lock as required.

## Board AA8 - Fractional division p.l.l.

Circuit diagram : Chap. 7, Figs. 7 & 8

167. One input to the board is from cavity oscillator buffer board AA6 at the 6 to 38 MHz difference frequency between the cavity oscillator and the translation oscillator. A 10 dB pad formed by R17,R18,R19 matches the 50 ohm mixer source input to the 75 ohm impedance of hybrid input buffer amplifier IC14. This amplifier has 18 dB gain (decreasing towards 6 MHz) and 30 dB reverse isolation; output level is typically 700 mV p-p. A second input is from 50 MHz crystal oscillator board AC1. Each input feeds to a driver. TTL driver stages TR1,TR2,TR3 and TR4,TR5,TR6 amplify the inputs so as to saturate the push-pull output switching transistors which are used to drive the following programmable dividers.

### Divide-by-N/2 programmable divider (Sheet 1)

168. The 50 MHz input from t.t.l. driver TR1,TR2 is used to clock IC3 which is a 4-bit up/down counter set to count down. This counter is fed with division ratio data in two sequential 4-bit words by data selector IC2 which obtains its input from 8-bit latch IC1. Data word selection and counter loading are controlled by D-type bistable IC4a. Together these four ICs form a divide-by-N/2 programmable divider. By alternately dividing by adjacent integers division is accomplished with increments of 0.5.

169. The data in the form of two adjacent 4-bit binary numbers comes from AB1 to AA8 on the 8 lines of the slow data bus, and is latched

by SLOW SELECT 1 onto the outputs of latch IC1. Data is loaded as follows:-

Data D3 D2 D1 D0 = binary code for [N/2]-2
& D7 D6 D5 D4 = binary code for [N/2 + 1/2]-2

For example: N = 25 D3 D2 D1 D0 = binary 10 = 1010
& D7 D6 D5 D4 = binary 11 = 1011

One of the two 4-bit data words appears at the output of data selector IC2 according to the state of the select line to IC2 pin 1. The 4 data lines load data into the down counter IC3 when LOAD pin 11 is taken low.

Divider operation

170. This divider operates similarly to the divide-by-N programmable divider on board AA7. The sequence of operations in the divider is as follows and commences with the counter counting down (refer to Fig. 9): IC3 counts down from the previously loaded-in number until the terminal count of zero is reached, upon which MIN COUNT goes high. This supplies the data input to IC4a, so that when this IC is clocked by the next positive-going edge the data is transferred as a low to the Q(L) output. The logical low provides the LOAD enabling signal to IC3 pin 11 and during this clock period the data on the A,B,C,D inputs is loaded into the counter. Also during this period, the counter is prevented from counting due to the LOAD input being held low by IC4a while, as a result of the loading, the terminal count on IC3 pin 12 returns low. On the next positive clock edge the counter LOAD input goes high as IC4a is clocked. The output of this bistable changes state and selects the alternative 4-bit word which appears at counter inputs A,B,C,D (this has no effect on the counter until the next counter load cycle takes place). Now that the counter LOAD input is high, on the next positive clock edge the count previously loaded can be counted down. The count is decremented by one for every clock edge until the terminal count is reached, when the cycle described above repeats. Output from bistable IC4a is therefore a pulse after every input cycle to the programmable divider.

171. For any value of 4-bit word loaded into the counter, one output cycle is produced by input cycles which are two more than the number loaded into the counter, e.g. for a loaded number of 8, ten input (clock) cycles produce one output cycle (see the example in Fig. 9 for board AA7). Also, if the number loaded in the first cycle were 8 the second 4-bit word would have the value of 7, 8 or 9 (since the numbers must be the same or adjacent). Thus for N = 19 the two words sequentially loaded into the programmable divider would be the binary codes for 7 and 8. The required division ratio of N/2 is produced by an output pulse after 9 input cycles followed by a pulse after 10 input cycles giving an average division ratio of 9.5. The divide-by-N/2 output supplies one input to the phase frequency comparator.

Divide-by-m programmable divider

172. The divide-by-m programmable divider is formed by 8-bit latch IC5, 4-bit up/down counter IC6 which is set to count up, fractional controller IC9,IC10 and J-K bistable IC8. The divider divides the AA6 input by a factor m which is determined by the two binary numbers latched into IC5 by SLOW SELECT 2. IC5 also latches the AA8 operating mode. The data latched in IC5 allows for the two clock periods required to reset the counter on each cycle. Binary data is carried on data lines LD0,LD1,LD2 to up counter IC5 and on LD4,LD5,LD6 to data selector IC10. The binary word loaded into the data

selector is 5 times the fractional value of m in steps of 0.2 as follows:-

| {m} | = | 0 | 0.2 | 0.4 | 0.6 | 0.8 |
|---|---|---|---|---|---|---|
| LD6 LD5 LD4 | = | 0 0 0 | 0 0 1 | 0 1 0 | 0 1 1 | 1 0 0 |

where {m} is the fractional value of m

The binary word loaded into the up counter is 9 - [m] as follows:-

| [m] | = | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| LD2 LD1 LD0 | = | 1 1 1 | 1 1 0 | 1 0 1 | 1 0 0 | 0 1 1 | 0 1 0 |

where [m] is the integer value of m

Data on LD7 determines the circuit function as follows:-

LD7 = 0 Forward locking mode
LD7 = 1 Lock-down mode

Division is either by M when TP3 is logically high or by M+1 when TP3 is logically low. IC6 is initially loaded with data on the A,B,C inputs from latch IC5, with its LD3 input held permanently high. The up counter is then clocked by the t.t.l. driver until MAX COUNT on IC6 pin 12 goes high when 15 (binary 1111) is reached.

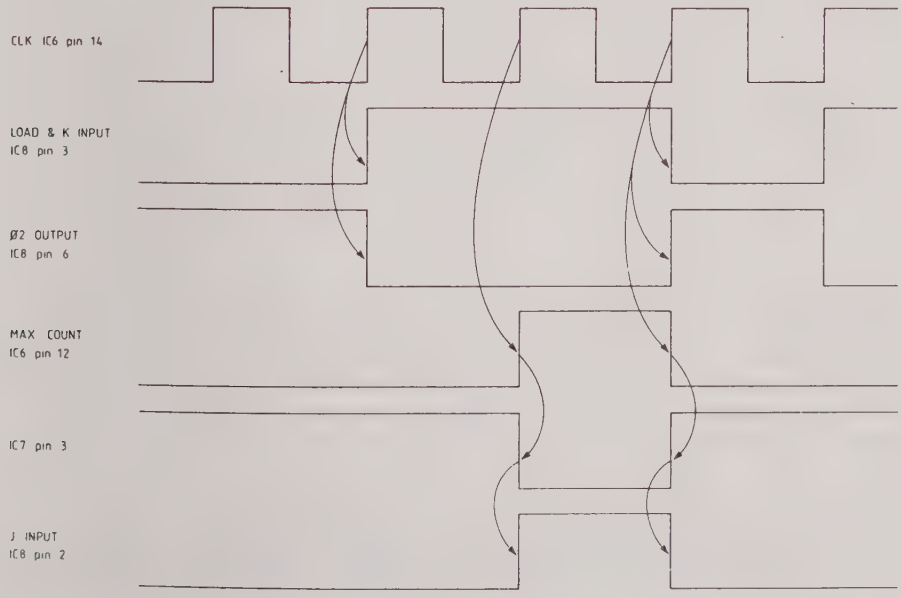


Fig. 10 Divide-by-m programmable divider in divide-by-M (integer division) mode - AA8. Example showing operation from a preset of 6 in the up counter.

Up counter operation

173. In divide-by-M mode TP3 is taken high by the fractional controller to hold open AND-gate IC7a. Similarly, the QD output from the controller holds open a second AND-gate, IC7b. These gates enable the MAX COUNT output from the counter to control the operation of the J-K bistable, and hence the

generation of the output pulses. When LOAD is clocked low from the bistable (whose Q output goes high to start the output pulse), the counter loads the binary number preset on its data inputs. Then when the next clock pulse occurs, LOAD is disabled and the output pulse is ended. Subsequent clock pulses increment the counter until 15 is reached which causes MAX COUNT to go high. This takes the bistable J input high and with the K input also high the next clock pulse restarts the cycle with another load. The flow diagram for this mode, using the example of a countup from a preset of 6, is shown in Fig. 10. Note that for latched data of 7, MAX COUNT is permanently high causing the bistable to divide by two.

174. In divide-by-M+1 mode TP3 is taken low by the fractional controller which closes AND-gate IC7a to the MAX COUNT signal, and opens IC7b. Now it is the QD output from the counter which controls the J-K bistable. The load and output pulse generation operations are similar to those for divide-by-M mode. But because the count cycle is terminated by the QD output, an extra clock pulse is needed to end MAX COUNT and reset the QD output to zero. The flow diagram for this mode is shown in Fig. 11 and uses the same preset example as for the divide-by-M mode shown in Fig. 10.

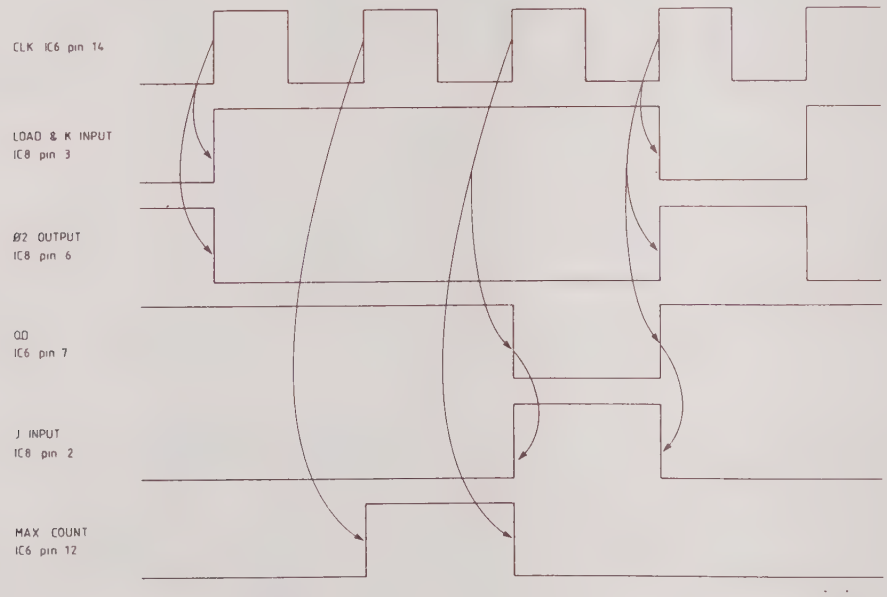


Fig. 11 Divide-by-m programmable divider in divide-by-M+1 (fractional division) mode - AA8. Example showing operation from a preset of 6 in the up counter.

Fractional controller operation

175. Fractional division is achieved by programming the logic state of TP3 to give the required divisions of M and M+1 in every 5 cycle period. The fractional controller performing this function consists of data selector IC10 and divider IC9 together with AND-gates IC7c and d configured as inverters. IC9 is clocked by the falling edge of the LOAD pulse from J-K bistable IC8a and produces two different pulse trains at QB and QD every 5 input clock cycles. These provide IC10 with data inputs at D2 and D1 as well as, after inversion, at D3 and D4. Two additional inputs D0 and D5 are provided by ground and the +5 V line respectively. Selection data on the LD4,LD5,LD6

lines from latch IC5 connect the required D input out in inverted form to TP3. This results in 5 waveforms which have from 0 to 4 high states in every 5 cycle period according to the division ratio required.

176. Overall fractional division is by m = M + P/5 where P/5 = {m} the fractional part of m. The fractional division is programmed as shown in Table 7.

TABLE 7 FRACTIONAL DIVISION - AA8

| Latch data LD6 | LD5 | LD4 | {m} | P | Cycle: 1 | 2 | 3 | 4 | 5 Division ratio | 5-cycle period mean division |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 0 | 0 | M | M | M | M | M | M |
| 0 | 0 | 1 | 0.2 | 1 | M | M | M | M | M+1 | M+1/5 |
| 0 | 1 | 0 | 0.4 | 2 | M | M+1 | M | M+1 | M | M+2/5 |
| 0 | 1 | 1 | 0.6 | 3 | M+1 | M | M+1 | M | M+1 | M+3/5 |
| 1 | 0 | 0 | 0.8 | 4 | M+1 | M+1 | M+1 | M+1 | M | M+4/5 |

Division ratio is M with TP3 high, and M+1 with TP3 low.

Phase/frequency comparator (Sheet 2)

177. The phase/frequency comparator generates a d.c. voltage proportional to the mean phase error between the two inputs. First stage is a phase frequency comparator made up of two bistables: IC11b clocked by O1, the divided down 50 MHz reference; and IC12b clocked by O2, the fractionally divided AA6 i.f. IC13a and b perform logic OR so that both bistables are set once both have been clocked. R28 and C28 provide a delay which lengthens the bistable output pulse width to 10 ns. The mean durations of the two sets of output pulses driving the current switches are equal when the cavity loop is in lock, i.e. when the two input frequencies O1 and O2 are equal.

178. The current switches consist of long tailed pairs TR7,TR8 and TR9,TR10 with constant current drive. Their collectors are cross-coupled by R50 network so that with both bistables set, TR8 and TR10 are conducting and equal voltages are presented to the differential input of IC18. When IC12b is clocked by O2, TR8 and TR9 conduct so that a positive correcting voltage exists at the differential input to IC18. The integrator ramps the varactor volts up, increasing cavity frequency and reducing AA6 i.f to restore lock. Conversely, when IC11b is clocked by O1, TR7 and TR10 conduct producing a negative correcting voltage which ramps the varactor volts down, reducing cavity frequency. When both IC11b and IC12b are clocked, TR7 and TR9 conduct and again equal voltages are produced at the differential input to IC18 while the bistables are being set.

179. Resistor network R50, together with shunt capacitors, filters out the frequency components due to O1 and O2. The correcting voltage to the integrator stage is zero when the mean duration of IC11b and IC12b output pulses are the same, i.e. the cavity loop is in lock. The amplitude of the correcting voltage is proportional to the constant current source of the long tailed pairs. Thus selection of constant current value provides a means of modifying overall cavity loop gain, and in consequence cavity loop bandwidth.

Loop gain control

180. Loop gain is selected by a circuit consisting of latches IC11a and IC12a, comparators IC15a and IC15b and c.m.o.s. switch IC16. The loop gain selector provides the long tailed pairs with 4 switch-selected constant current values determined by 4 pairs of emitter resistors. These enable a nominal cavity loop bandwidth of 10 kHz to be selected over the range of cavity frequencies determined by m and N. Switch selection is controlled by 2-bit binary data D0,D1 which is latched on IC11a and IC12a by SLOW SELECT 3 from AB1. Comparators IC15a and IC15b invert and provide c.m.o.s. compatible levels to control switch IC16. Gain selection is determined as follows:-

| D1 | D0 | Selected resistors |
|---|---|---|
| 0 | 0 | R34, R38 |
| 0 | 1 | R33, R37 |
| 1 | 0 | R32, R36 |
| 1 | 1 | R31, R35 |

In lock-down mode with latch IC5 output LD7 high, inverter IC13c switches off TR16 thereby inhibiting the current source.

Varactor drive

181. The varactor drive stage has the ability to bias the varactor for the cavity oscillator on AA6a with a voltage of up to +50 V. This stage can be configured either as an integrator in forward locking mode or as an inverting amplifier with a gain of 3 in the lock-down mode.

182. The high voltage output stage consists of differential amplifier IC18, a long tailed pair with constant current sink, and a high voltage current driving stage. TR11 and TR13 form the long tailed pair with TR12 providing a 1.5 mA constant current sink, the voltage developed across R70 enabling TR13 collector to swing between -10 V and +60 V. TR14 is an emitter follower which provides the current drive into feedback resistors R64 and R65 which configure the output stage so that there is a voltage gain of 3 between TR11 base and TP8. R63 limits TR14 current so that maximum voltage at TP8 is nominally +50 V. TR15 circuit behaves as a limiter, with D3 conducting to prevent varactor volts falling below a nominal +3 V whenever TR4 emitter voltage falls to a low level. This is necessary because the varactor in AA6a cavity oscillator requires sufficient bias to maintain circuit Q.

Function selection

183. The function selector configures the mode of operation of the output stage, and is controlled by data on the LD7 line latched from IC5. Comparators IC15c and IC15d translate the t.t.l. data levels to c.m.o.s. control levels for quad switch IC17.

184. In forward locking mode with LD7 low, IC17 configures the output stage as an integrator. IC17c switches the phase frequency comparator output to IC18 differential input, with the integrating element being the cavity loop filter connected between the high level output at TP8 and the IC18 inverting input. To improve stability of locking, an additional band limiting capacitor, C50 is connected by IC17a across IC18 to provide negative feedback. Diodes D1 and D4 restrict the excursion of the inoperative terminal of the c.m.o.s. device to within supply rail limits; this prevents a secondary effect from modifying cavity loop noise sidebands.

185. In lock-down mode with LD7 high, IC17 configures the output stage as an inverting amplifier due to IC17d grounding the IC18 non-inverting input. Weighted inputs LOCK DOWN HF PATH and LOCK DOWN MAIN PATH at PLH pins 3 and 4 are connected in by IC17b and summed with a gain of 3; with zero input, R72 sets the stage output bias to +28 V. The integrating elements for the mode consist of the two complementary CR networks C36,R51,C37 and C38,R52,C39. These are the loop filters which determine the phase locked loop bandwidth, and are designed for a natural frequency of 10 kHz.

## Board AA12 - Divide by 16

Circuit diagram : Chap. 7, Fig. 5

186. Input from cavity oscillator buffer AA6 in the range 517 to 545 MHz is coupled by C1 to e.c.l. divider IC1 which divides by 16. Output from C4 is via oscillator selection board AB7 to the frequency counter on AD38. This also enables the YIG tuned oscillator frequency to be set and measured on wide sweeps when it is free-running. By using the cavity oscillator output which is harmonically phase locked to the YTO and then dividing by 16, the frequency is brought low enough to be acceptable to the frequency counter. Since output from AA12 is only required for counting purposes, when SWEEP TRIG is taken low by AD2 during a sweep, it switches on TR1 which reverse biases D1 so that the output is disabled. During the flyback period SWEEP TRIG goes high, TR1 switches on and D1 is forward biased so enabling the output.

## Board AB1 - D to A converter

Circuit diagrams : Chap. 7, Figs. 12 to 16

187. This board provides, by means of D-A converters, the analogue voltages enabling the microprocessor to control the operation of the YIG-tuned, l.f. master and interpolation oscillators. Front panel frequency selection is implemented by generating reference voltages for each of the voltage controlled oscillators. To enable frequency sweeping, a voltage ramp is generated through attenuators which define the sweep limits. Control signals are produced for controlling tracking generator operation, for setting i.f. gain and tuning the i.f. filters, for selecting input attenuation and for routeing oscillator output to the frequency counter for display. The board also contains the +70 V and +15 V line regulators.

### Sweep voltage generation (Sheets 1 & 2)

188. When chip select lines CS60 and CS61 are sequentially taken high by the microprocessor, the data present on the quiet data bus at that time, consisting of all 1's, is latched out from IC10 and IC11 respectively. This data provides the binary preset for down counters IC7,IC8,IC9 which are loaded when the processor pulses IC11 pin 19 low to the COUNT/LOAD line. The counter outputs supply the changing inputs to the 12-bit sweep D-A converter IC3. When the COUNT/LOAD line returns high, the counters are clocked by the square wave on the SWEEP CLOCK line, converted to t.t.l. by TR1, and the count down commences. Clock rate is variable to compensate for oscillator non-linearity. Output from the converter is a sawtooth of $2^{12} = 4096$ discrete steps and this is summed by IC4 with the output from D-A converter IC6. The 8-bit D-A produces a step to eliminate error due to an integrator's inability to track a sawtooth waveform. The amount of this offset is related to the

sweep D-A clock rate. The sawtooth is used to sweep the synthesizer v.c.o's. Oscillator full sweep is set by the following sweep attenuator. This is formed from the potential divider R6 to R13 and the 8 output selection switches comprising quad f.e.t's IC15 and IC16. Switch control is exercised by IC12 whose selection data is latched out when clocked by the CS63 line. The appropriate line is latched high via one of the level shifters formed by IC13 and IC14 which causes the selected f.e.t. to switch on. For example, when IC15a is switched on it enables a full sweep of 4200 MHz for the YTO, of 2 MHz for the l.f. master oscillator on AB3, and of 640 kHz for the interpolation oscillator on AB2. If, instead, IC21b is switched on these frequency ranges are halved.

TABLE 8 SWEEP INTEGRATION - AB1

| Sweep time | IC17 pins | | | | | | Integrator Time constant |
|---|---|---|---|---|---|---|---|
| | 2 | 5 | 6 | 9 | 12 | 15 | |
| 100 ms | L | H | L | L | L | L | 1.1 ms |
| 200 ms | L | H | L | L | H | L | 2.2 ms |
| 500 ms | L | H | L | L | H | H | 5.6 ms |
| 1 s | L | L | H | L | L | L | 11.1 ms |
| 2 s | L | L | H | L | H | L | 22.2 ms |
| 5 s | L | L | H | L | H | H | 55.5 ms |
| 10 s | L | L | L | H | L | L | 111 ms |
| 20 s | L | L | L | H | H | L | 222 ms |
| 50 s | L | L | L | H | H | H | 555 ms |
| 100 s | L | L | L | L | L | L | 1.12 s |
| 200 s | L | L | L | L | H | L | 2.24 s |
| 500 s | L | L | L | L | H | H | 5.61 s |
| Bypass | H | L | L | L | L | L | - |

189. The sweep integrator consists of a D-latch operating various switches to select the RC components providing the time constant appropriate to the sweep time selected. When chip select line CS64 goes high, selection data is clocked out from IC17 via level shifters IC18,IC19 to control f.e.t. switches TR2,TR3 and IC20. These switch into circuit combinations of resistors R22 to R25 and capacitors C27 to C30. For example, for a sweep time of 200 ms IC17 pins 5 and 12 are taken high which switch on TR3 and IC20c respectively. The switches select R25 in parallel with R22 and C28 in parallel with C27 to provide an integration time constant of 2.2 ms (see Table 8). During sweep flyback, TR2 is switched on to bypass the resistors and allow the capacitors to discharge.

190. The sawtooth output from the sweep integrator is next fed to the bi-directional slew rate limiter. The purpose of this circuit is to slow the rate of rise and fall of the positive- and negative-going ramps which would otherwise allow phase lock to be broken. Limiter output is fed back to the inverting input of IC21 for comparison with the incoming signal. On the occurrence of a rising ramp at the non-inverting input of IC21, the instantaneous voltage difference at the inputs causes the comparator output voltage to rise. This forward biases D3 and reverse biases D1 and D4 which enables C31 to charge via D2 from constant current source TR4. On the occurrence of the falling ramp, the output voltage from IC21 falls which forward biases D1 and reverse biases D3 and D2. This enables C31 to discharge via D4 to constant current drain TR5. C31 is thus charged and discharged at a controlled rate as required. R26 and R27 equalise the input bias to IC21 while D5 with D6,D7 limit the comparator output voltage excursions. The modified sawtooth is fed from emitter follower TR6 to the output selection switches.

191. When line CS65 clocks D-latch IC22, output selection logic on pins 2, 5 and 6 is fed via the level shifters comprising IC23 to operate one of the three f.e.t. output switches TR7, TR8 or TR9. When TR8 or TR9 is switched on, the sweep signal is routed respectively to either the l.f. master v.c.o. on AB3 or the interpolation v.c.o. on AB2. The associated switch TR27 is used for testing purposes when both l.f. master and interpolation oscillators are made to sweep together. Both are exercised over a much wider frequency sweep range which also increases the sweep rate since the sweep period is unaltered. When the third output switch TR7 is switched on, the sweep signal is fed to the YTO via differential amplifier IC24a on the SWEEP line to AJ8. The GROUND SENSE input to the amplifier from AJ8 ensures that the output sweep voltage is maintained at the correct level relative to the AJ block ground.

Reference level generation (Sheet 2)

192. IC35 supplies the 5 V reference which is used for the reference level D-A converter, the 70 V line regulator and, via potential divider R45,R46, the 1.5 V reference for the board level shifters. The D-A converter consists of three 8-bit converters ICs 29, 30 and 31 whose input data is applied from D-latches ICs 32, 33 and 34. The latches are sequentially clocked by chip select lines CS70 to CS72 to load the binary data from the quiet data bus. Output from the first converter is voltage converted by IC27a, attenuated by R48 and then summed with the output from the second converter. This process is repeated by IC27b, R51 and IC28. Due to the attenuation, each preceding converter output is one sixtyfourth that of the following thus enabling the REF FREQUENCY VOLTAGE output to interpolation oscillator AB2 and l.f. master oscillator AB3 to be accurately set. The voltage to AB2 is applied when IC22 pin 16 is taken high to level shifter IC25d. This supplies the REF FREQ ENABLE voltage which switches on TR12. Similarly, IC23d supplies the REF FREQ ENABLE voltage to the enable switch on board AB3. For the two lowest used sweep ranges of 100 Hz and 200 Hz, IC22 pin 19 is taken high and, via IC25c, switches on TR11 to supply additional low-pass filtering for AB2. When IC22 pin 12 is taken high, IC25a output switches on TR10 and differential amplifier IC24b supplies the YTO REF FREQ VOLTAGE to AJ8. The GROUND SENSE input from AJ8 ensures that the reference voltage is maintained at the correct level relative to the AJ block ground.

193. The INTERP OSC SWEEP ATTEN CONTROL line to AB2 controls the sweep limits of the interpolation oscillator. When this line is taken high by IC18c, sweep span is 10 times greater than when the line is low.

Control signals (Sheet 3)

194. Microprocessor control signals are applied by means of five 8-bit multiplying D-A converters. Filter centre frequency adjustment for AC3 is controlled by D-A converter IC36 and output op-amp IC41b. When clocked by CS73 the selected control voltage in the range 1 to 11 V is fed to filter IC41a and then sent on the CENTRE FREQ ADJUST line to control the varactor diodes providing filter tuning for AC3. IF gain for this board is controlled by D-A converter IC37. When CS74 is taken high, the output is amplified by 2 by IC42c before being applied on the 2.6 MHz IF GAIN ADJUST line to AC3. Tracking generator output level is similarly set by IC39 and IC42b and is output on the TG LEVEL line to AK14 when CS76 is taken high. DC marker null D-A converters IC39,IC42b and IC40,IC42d supply outputs of 0 to 10 V to AH12 when enabled by CS145 and CS146 respectively. This board uses the voltages to adjust the varactor and pin diodes on first mixer board AH2.

Control latches

195. Oscillator control latch IC43 provides enable/disable signals for the tracking generator, calibrator, YTO loop sampling gate and l.f. master oscillator phase locking. It also selects the required input to the frequency counter from the cavity, l.f. master or interpolation oscillator. Input attenuator latch IC44 provides all the signals for controlling the operation of attenuator control board AB8. The YIG control and slow data strobes latch IC45 controls the lst mixer input d.c. stabiliser, and the operation of the YTO via AJ8. It also supplies the clocking signals for the latches holding the N and m division ratios and the cavity loop gain setting on boards AA7 and AA8. Slow data bus latch IC46 supplies the data for the latches on AA7 and AA8 holding the N and m division ratios which are clocked out by IC45 above.

YTO count system (Sheet 4)

196. Board AB1 implements the lock-down mode of operation in which the YTO is free-running (i.e. not locked to the l.f. synthesizer). To set the frequency parameters accurately it is necessary to measure the YTO frequency which cannot be done directly due to its high value. Instead this board enables the cavity oscillator to be tuned until its harmonic is phase locked to the YTO. Since the harmonic is known, the YTO frequency can be calculated. The YTO count system is summarised in Fig. 12.

TABLE 9 CONTROL LINE FUNCTIONS - AB1

| Control line | Function | |
|---|---|---|
| | Logical '1' | Logical '0' |
| D0 | Search osc +ve start | Search osc -ve start |
| D1 | Enable search osc | Disable search osc |
| D2 | Disable integrator preset | Enable integrator preset |
| D3 | Enable hold off discharge cct | Disable hold off discharge cct |
| Data latched by Chip Select 144 | | |

* As for pretune

197. When clocked by CS144, data on the quiet data bus is loaded into control latch IC53 whose logic levels on data lines D0 to D3 control the YTO

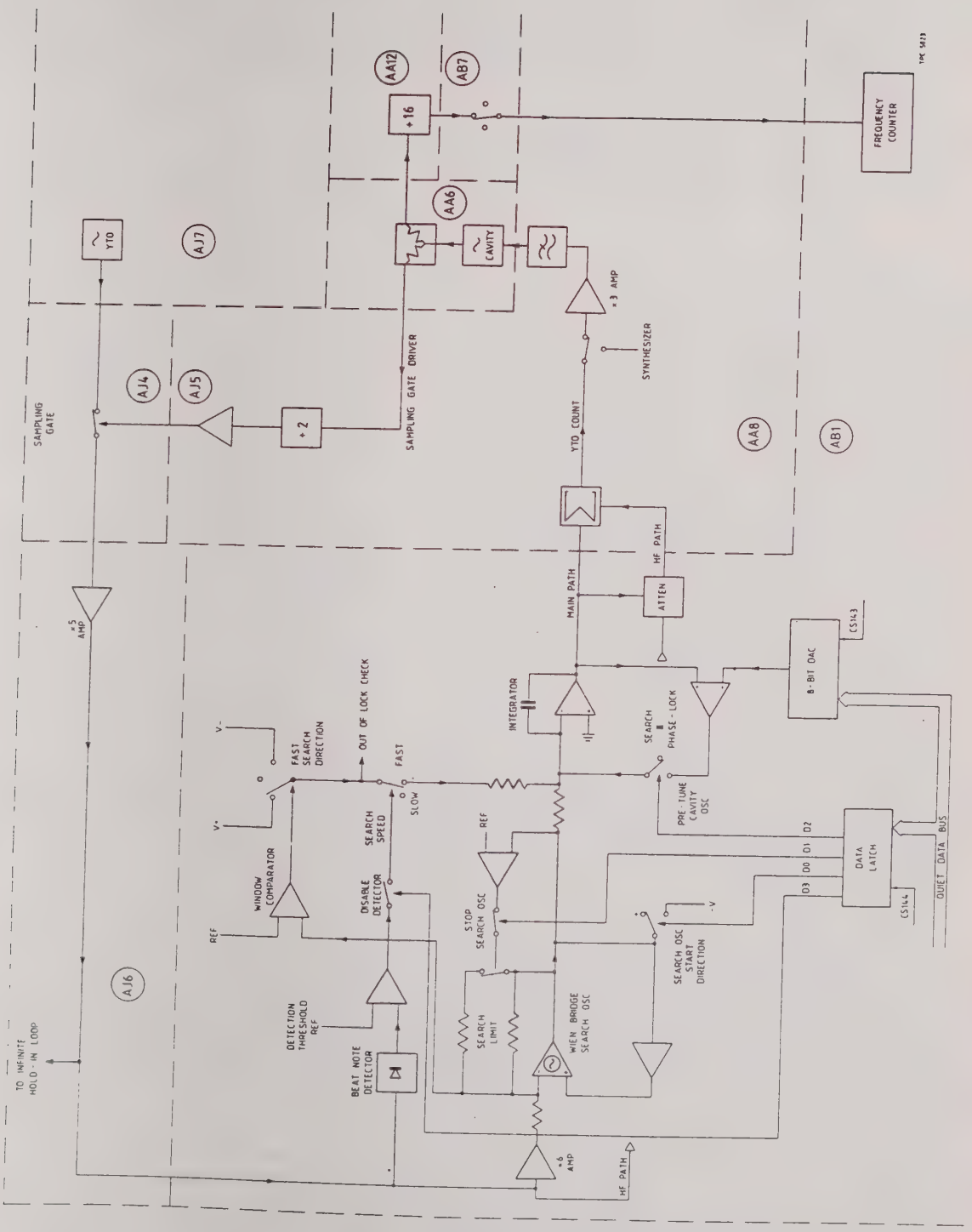


Fig. 12 YTO count system summary.

count system. The functions performed are shown in Table 9 and the modes selected are shown in Table 10. All data lines are routed through DIL switch SA206 whose contacts are normally closed, but which can be used to reconfigure board operation for testing purposes. Also for testing, the link on PLTF may be changed from the normal AUTO position to the DEBUG position which takes all the outputs low and causes l.e.d. D9 to illuminate to warn that the control latch is inoperable.

TABLE 10 MODE SELECTION - AB1

| Mode | Data lines D0 D1 D2 D3 | Data latched into IC56 |
|---|---|---|
| YTO synthesised | X 0 0 0 | 255 |
| Pretune cavity osc below a lock point | 0 0 0 1 | As required to tune cavity oscillator to desired frequency |
| Pretune cavity osc above a lock point | 1 0 0 1 | |
| Lock cavity osc to YTO (after pretuning) | * 1 1 0 | No change to data after pretune |
| Data latched by :- | CS144 | CS143 |

* As for pretune

Search oscillator

198. The lock-down signal from AJ8 enters the board at PLAJ 13 where the minimum beat note amplitude is set by R84. The signal is fed via amplifier IC47, which provides a gain of 6, to search oscillator IC48a. This is a Wien bridge oscillator which operates at 5 Hz and has a forward gain of 3. Its output oscillations are converted to approximate square waves by being fed to the window detector formed by comparators IC52c and IC52d. Window limits of +3.25 V and -3.25 V are set by the potential dividers R109,R110 and R111,R112. When, during search, the oscillations exceed the window limits, the comparators switch TR14 off. This allows f.e.t. TR13 to switch on, which connects R101 in parallel with gain resistor R99 so reducing gain to below that necessary to maintain oscillation, and hence limiting output amplitude. The resulting 7 V p-p square wave is integrated by IC55a whose output on the YTO COUNT LOOP MAIN PATH to AA8 is a triangular wave of between 400 and 600 mV as required to slow sweep the cavity oscillator. When necessary, search may be disabled by a low output from control latch IC53 on the STOP SEARCH OSCILLATOR line. This closes switch section IC51b so holding TR14 off and TR13 on.

199. Since the YTO frequency is approximately known by the processor, it tunes the cavity oscillator so that a harmonic is just below the frequency of the YTO and this is done by means of 8-bit D-A converter IC56. Firstly, switch section IC51c is closed so that integrator presetting comparator IC55b provides a feedback path for the loop integrator. Then the converted data from the quiet data bus is fed into the loop by the comparator so causing the cavity v.c.o. to be preset in frequency. For testing purposes the link on PLTE may be changed from the normal AUTO to the DEBUG position which allows IO adjustment by means of R142.

200. Once the frequency of the cavity oscillator has been set by the processsor, the oscillator search direction (which is now known) can be initially set and this is the function of comparator IC48b. The processor takes the SEARCH OSC DIRECTION line low from control latch IC53 which closes switch section IC51a and connects the op-amp inverting input to the negative rail via R106. This steps the comparator output up by 0.4 V and gives the search oscillator a positive start which results in the cavity oscillator being tuned towards lock with the YTO. This is the normal mode of operation; on occasions such as when calibrating or testing, a logical low is used to pretune the search oscillator in the opposite direction. Note that the comparator output levels of ± 0.4 V are lower than the ± 0.6 V necessary to start the fast search operation.

Fast search switching

201. Having preset the cavity oscillator harmonic close to the YTO frequency and also set the initial direction of the search oscillator, the processor now needs to set the initial search to fast so as to achieve lock as quickly as possible. This is the function of the fast search switching circuit formed by window detector IC52a,IC52b and f.e.t. switch TR15. When the input to the search oscillator is greater than the window limit of +0.6 V set by potential divider R118,R119, comparator IC52a switches on TR15 which acts as a current source from the +5 V rail via R131 to the summing input of the integrator. And when the other limit of -0.6 V is exceeded, current is sunk from the integrator via R131 and R123. Due to the respective values of R131 and R115, a current 90 times greater than that from the search oscillator is fed to the loop integrator. The greater amount of current sourced and sunk by this circuit results in a faster rising and falling output ramp since the rate at which the integrator output voltage changes is dependent upon the amount of input current. The output on the YTO COUNT LOOP MAIN PATH to AA8 is a truncated triangular wave of between 20 and 30 V p-p as required to fast sweep the cavity oscillator.

202. Whenever TR15 switches on it causes LOCK CHECK l.e.d. D11 to flash to indicate the unlocked state. And providing switch section IC51d is closed, it also switches on TR16 which causes the FAST SEARCH INDICATOR l.e.d. D12 to flash. The states of the lock check and fast search lines from this board as well as the LOCK CHECK line from AJ8 are read by the processor from buffer IC54 whenever the CS142 line is pulsed low.

203. As the loop nears phase lock it is necessary to switch from fast to slow search to ensure capture. This is done by detecting the beat note using the circuit formed by IC49 and IC50. The signal is buffered by IC49 then half-wave rectified by D8,C69,R92 and the resulting d.c. is compared by IC50 with a reference at the non-inverting input of 180 mV set by R93,R94. D31 at the reference input provides temperature compensation for D8. If the input level exceeds the reference, a low logic level results which switches on TR17 and enables C76 to charge from the +5 V rail. This takes the line high to switch section IC51d whose contacts then open to disable the fast search operation.

204. When the loop achieves lock, the beat note disappears causing the detector to switch off TR17. Normally, this would cause the fast search switch to close which must be prevented since, at this time, one of the fast search switching comparators might be in the active state causing lock to be immediately lost. The time constant of C76,R130 provides the necessary delay to allow the fast search operation to end. When phase lock is achieved, the

loop gain is such that further operation of the search oscillator is suppressed.

205. If the YTO is tuned with the loop in lock, a beat note would be initially produced which would be detected causing fast search to be disabled as described above. And due to the delay imposed by C76,R130 the fast search switch could not be re-closed in time for the signal to be tracked so that lock would be lost. To prevent these effects the processor, prior to tuning the YTO, takes the HOLDOFF DISCHARGE ENABLE line high from the control latch. This switches TR30 on to disable the beat note detector while simultaneously discharging C76 via IC47b.

HF path

206. Besides the MAIN PATH output to AA8 a secondary path is provided which bypasses the lock-down loop and connects directly to the output via a frequency sensitive attenuator. This is the HF PATH which sets the dynamics of the phase locked loop. D35 provides the attenuator which is controlled by the integrator output. C135 and C136 are d.c. blocking capacitors. As the output voltage falls to increase the cavity v.c.o. frequency (the output from this board is inverted on AA8), the current through D35 is caused to fall so increasing the path attenuation. Both paths are summed on AA8 which enables the attenuator to linearise the loop gain at small signal levels.

+70 V line regulator (Sheet 5)

207. The +80 V line from AR2 is connected to series-pass transistor TR19 which supplies a regulated +70 V for board AB3. The output is potential divided by R159,R160 and the junction sampled on pin 3 of comparator IC57. If, for example the output current rises, comparison with the 5 V reference on IC57 pin 2 causes output pin 6 to become more positive so increasing the conduction of TR21. This decreases the base drive for TR19 and hence decreases the output current. IC57 pin 6 going low switches on l.e.d. D17 to indicate the out of regulation condition. Short circuit protection is provided by TR18 and TR20. In this case the increased current through R148 develops enough potential to forward bias TR18 which then switches on. This causes TR20 to switch on and take TR19 base to ground and thus to disable the output.

Line regulators

208. The purpose of the line cleaner circuits on this board is to remove any low frequency a.c. component on the d.c. supply lines. The line cleaners operate on a feedback principle. Ripple voltage at the line cleaner output is compared with a quiet reference and an error current is generated. The voltage developed by this current across a resistor in series with the supply rail is equal and opposite to the applied ripple component. In this way, the ripple voltage at the input is cancelled and the output is ripple-free. All the line cleaners operate similarly to the +15 V one described in detail below.

209. The +15 V line cleaner consists of differential amplifier IC58 and current driver TR22 which operate in a feedback system. IC58 controls TR22 which provides the current drive with a standing value of 40 mA. The system maintains the a.c. component on C92 (i.e. the +15V LC(A) ripple content) at the same level as the quiet ground reference on C93. Any ripple on the +15V LC(A) output is sensed by R165,R166 and fed via C92 to IC58 as an error signal. This causes the inverting input of IC58 to go more positive

increasing p.n.p. TR22 conduction to bleed away the extra current so restoring the original level. IC58 output voltage thus constrains the TR22 emitter current flowing through R165,R166 to cancel the ripple component.

210. Feedback also controls the d.c. standing voltages. These are stabilised with the voltage on IC58 non-inverting input (determined by potential divider R163,R164 between +15V REG and TR22 collector) equal to the voltage on IC58 inverting input (determined by divider R161,R162).

211. R168,C93 form a low-pass filter with very low cut-off frequency so that ripple components down to 5 Hz do not disturb the quiet ground reference on the IC58 non-inverting input. D18 speeds up settling time at switch-on by enabling C93 to quickly attain the reference level. D20 provides 8.2 V Zener drop which reduces TR22 dissipation.

212. The +15V LC(B) line cleaner operates similarly to that for the +15V LC(A) line. The -5 V line cleaner is also similar to the +15 V ones except that it is a voltage mirrored version, and the Zener dropper and input potential divider are not required. Since the negative voltage regulators on AR2 have less ripple suppression at 120 kHz, the -15 V cleaner on board AB1 has an additional stage to provide extra current drive at this frequency. This is provided by TR26 whose collector current increases as emitter load impedance goes low at the series resonant frequency set by L2 and C104.

## Board AB2 - Interpolation oscillator

Circuit diagram : Chap. 7, Fig. 17

213. The purpose of this board is to provide continuous frequency coverage at the first local oscillator output when the l.f. master oscillator is phase locked to a harmonic of a 100 kHz comb.

214. When narrow sweeps are required, the l.f. master is phase locked to a 100 kHz harmonic and a sweep voltage from AB1 is applied to the interpolation oscillator. 20 kHz is the widest sweep obtainable using this oscillator and 100 Hz is the narrowest. When sweeps wider than 20 kHz are required or the user has selected zero span, no sweep or reference voltages are switched to this board and a standing bias maintains a stable output frequency of about 28.6 MHz.

### Oscillator

215. For spans of 100 Hz to 20 kHz frequency control of Colpitts oscillator TR1, in the range 28 to 32.5 MHz, is by the voltages on the REF FREQ IN and SWEEP lines to varactor diodes D1 to D4. These tune the tank circuit formed by T1, C2 and C3. The basic operating frequency, determined by the keyboard selected frequency, is set by the voltage on the REF FREQ IN line from the D-A converter on AB1. Oscillator sweeping is implemented by the voltage from the ramp generator on AB1. Attenuators on AB1 define the sweep limits and are complemented by the switched attenuator on this board. For a selected span of between 100 Hz and 2 kHz the SWEEP voltage is fed through attenuator R10, R47, R11 and R12. For spans of between 5 kHz and 20 kHz the SWEEP ATTEN CONTROL line switches on f.e.t. TR2. This causes R10,R47 to be bypassed thus reducing attenuation by a factor of 10 to make the sweep limits ten times greater. T1 provides coarse control of the frequency, while D8 and R12 together with C2 and C3 reduce the temperature coefficient of the oscillator. C5 provides a.c. coupling to avoid the varactor tuning voltage from being

shorted to ground. The oscillator operates at a frequency 32 times higher than required to allow subsequent division by 32 on AB6. This is in order for the noise components present in the output from a free-running oscillator to be reduced by a factor of 32. The division also affects the sweep operation; for a selected span of 20 kHz the actual oscillator sweep is 640 kHz.

216. For sweeps wider than 20 kHz or for zero span the frequency is set to approximately 28.6 MHz by the standing bias provided by R4, R5 and R6. Decoupling is provided by C6 which helps to reduce phase noise. When a REF FREQ voltage is applied, the high resistance bias line is overridden and it is the reference voltage which appears on the varactors.

217. To achieve the required frequency stability and low phase noise, the incoming supply is regulated by IC1 before power is routed to the oscillator. R42 and C33 on the internal voltage reference reduce phase noise on the oscillator output. Since the +5 V line determines the free-running frequency of the oscillator, regulator IC2 fed from the +15VLC line maintains the +5 V supply constant at the REF FREQ input to the varactors.

218. Output from TR1 source is a.c. coupled by C4, at a level of 60 mV p-p, into an amplifier formed by TR3, a series feedback stage, and TR4, a shunt feedback stage. Combined, the two stages form a buffer with a gain of +25 dB and a low impedance output. After limiting by diodes D6,D7 the signal at 1.1 V p-p is divided in power splitter T2,T3 which has 40 dB of isolation between output ports and an insertion loss of 4 dB. 9 dB of gain is provided by output buffer amplifiers TR5 and TR6 which are grounded-base stages having a reverse isolation of 60 dB. L5 and L6 prevent oscillation at 1.2 GHz. Output level is 2 V p-p after matching into 50 Ω loads by T4 and T5. This is fed to AB6 for frequency division by 32, and to AB7 for oscillator selection purposes.

## Board AB3 - Master v.c.o.

Circuit diagram : Chap. 7, Fig. 18

219. This board contains the master v.c.o. which covers the frequency range of approximately 30 MHz ±4 MHz and can be either swept for spans of 50 kHz to 2 MHz, or phase locked in 100 kHz increments anywhere over this range.

### Oscillator

220. Frequency control of Colpitts oscillator TR1 in the range 25.75 to 34.25 MHz is by voltages on the REF FREQ IN, SWEEP and PLL CONTROL lines to varactor diodes D1 to D3. The basic operating frequency of the v.c.o. is determined by the voltage on the REF FREQ IN line from the D-A converter on AB1. This voltage is stored in C42. When the oscillator is operating in the p.l.l. mode, frequency setting is by the D-A output being momentarily applied to C42 when the REF FREQ ENABLE line from AB1 goes high to switch TR9 on. The stored voltage is then sent by voltage follower IC2a to varactor diodes D1 and D2 which control the frequency of master oscillator TR1 as well as out on the REF FREQ OUT line to AB5 to coarse tune the slave oscillator. For phase locking, the voltage on the PLL CONTROL line from AB4 is fed to varactor D3. Any tendency for frequency drift due to leakage by C42 is compensated for by a proportion of the PLL CONTROL voltage monitored by IC2b being used to recharge the capacitor. When the oscillator is operated in the sweep mode, the phase locked loop is disabled on AB4 and frequency control of

the v.c.o. is taken over by the voltage on the SWEEP line from AB1. In this mode, f.e.t. switch TR9 is held on and the REF FREQ IN voltage is applied continuously.

221. Reduction of phase noise is achieved by decoupling both the internal reference of supply regulator IC1 by R42,C36 as well as the -12 V supply rail by R8,C9.

Output

222. Output from TR1 source drives into an amplifying stage formed by TR3 with series feedback and TR4 with shunt feedback. The stage provides a gain of 23 dB. After limiting by diodes D4,D5 the signal at 1.1 V p-p is divided in a power splitter having 40 dB of isolation between output ports and a loss of 4 dB. 9 dB of gain is provided by output buffer amplifiers TR5,6 and 8, which are grounded-base stages having a reverse isolation of 60 dB. Output level is 2 V p-p into 50 Ω.

## Board AB4 - Sampling gate

Circuit diagram : Chap. 7, Fig. 18

223. Board AB4 is used to phase lock the AB3 oscillator to the 50 MHz reference from AC1. Input from the master v.c.o. on AB3 in the range 26 to 34 MHz to balanced buffer TR1,TR2 is fed to the first sampling gate formed by D1 to D4. Drive for the mixer originates in the 50 MHz input from AC1. Following division by 500 by ICs 4,5 and 6 the resulting 100 kHz is connected to the pulse shaper. IC6 has its divide by 2 section before the divide by 5 so that a 1:4 mark/space ratio is produced. TR8 and TR9 provide a high-level drive for the pulse shaping components C10 and L2. The circuit is basically a differentiator and produces positive and negative pulses from the respective leading and trailing edges of the square wave input. The leading, positive pulse switches on n.p.n. pulse driver TR5 for 50 ns and this produces two antiphase pulses from the outputs of T2. T1 passes these without attenuation to the sampling gate but presents a high impedance to any common mode signals. This prevents any loading of the input signal during the gate open time. C8 is the hold capacitor and the gate output is buffered by f.e.t. input IC1. IC1 has a stretcher capacitor C9 which increases the loop bandwidth by compensating for the slew-rate limitation of the op-amp. The buffer formed by TR3,TR4 follows which lowers the source impedance for the second sampling gate.

224. The negative pulse from the pulse shaper switches on p.n.p. pulse driver TR6 to operate the second sampling gate formed by D8 to D11. Since the negative pulse is derived from the trailing edge of the divider output the second gate operates in antiphase to the first. It also has a larger hold capacitor whose effect is to reduce the 100 kHz ripple otherwise present on the PLL CONTROL line. A second pulse stretcher IC2 follows which has an offset control to centralize the capture range of the loop. An attenuator adjusts the loop gain before the PLL CONTROL signal is fed out from the lead/lag filter to AB3. For v.c.o. sweep operation, the p.l.l. is disabled by a high logic level on the PHASE LOCK ON line from AB1. This switches on TR7 to take the output from the second sampling gate to ground as well as disabling first counter stage IC4.

## Board AB5 - Slave v.c.o.

Circuit diagram : Chap. 7, Fig. 19

225. The AB5 oscillator is permanently phase locked to the sum of the frequency of AB3 and the frequency of AB2 divided by 32.

### Oscillator

226. Frequency control of Colpitts oscillator TR1 in the range 26.65 to 35.15 MHz is by the voltages on the REF FREQ IN, SEARCH SIGNAL and PLL CONTROL lines to varactor diodes D1 and D2. C5 provides a.c. coupling to avoid the varactor tuning voltage from being shorted to ground. Operating frequency is roughly set by the voltage on the REF FREQ IN line from the master oscillator on AB3 which operates approximately 1 MHz lower than the slave. Main loop control is by the voltage from AB6 on the PLL CONTROL line to IC2. IC2 sums this voltage with that from AB6 on the SEARCH SIGNAL line which ensures that the master/slave frequency relationship is maintained. The latter line is decoupled by R55 and C36 to reduce any noise component when the loop is locked.

### Output

227. Output from TR1 source is a.c. coupled by C4 into an amplifier formed by TR3, a series feedback stage, and TR4, a shunt feedback stage. Combined, the two stages form a buffer with a gain of +25 dB. After limiting by diodes D3,D4 the signal at 1.1 V p-p is divided in power splitter T1,T2 which has 40 dB of isolation between output ports and an insertion loss of 4 dB. 9 dB of gain is provided by output buffer amplifiers TR5 and TR6 which are grounded base stages having a reverse isolation of 60 dB. L5 and L6 prevent unwanted oscillation. Output level is 1.5 V p-p after matching into 50 ohm loads by T3 and T4. One output goes for loop control to board AB6 the other feeds out to translation loop board AA7.

## Board AB6 - Phase detector

Circuit diagram : Chap. 7, Fig. 19

228. This board phase locks the AB5 slave oscillator to the sum frequency of the AB3 master oscillator and the AB2 interpolation oscillator divided by 32. A search oscillator sweeps the slave until the correct lock is found when search is disabled. The board also contains the detector which ensures that the frequency of the slave v.c.o. is maintained higher than that of the master.

229. The 27 to 35 MHz input from the slave v.c.o. on AB5 is mixed by X1 with the 26 to 34 MHz input from the master v.c.o. on AB3. The difference frequency of approximately 1 MHz is fed to the buffer formed by TR2,TR3. TR2 provides 20 dB of gain and feeds into emitter follower TR3 which gives a low impedance drive for the following two phase discriminators. Filter L1, C6 isolates the input from discriminator switching signals.

230. TR1 buffers the 28 to 32 MHz input from AB2 to t.t.l., and the signal is first divided by 16 in IC1 before being applied to two parallel divide by 2 stages formed from IC3. These are D-type bistables whose data inputs are supplied from the Q(L) output of IC3a so that each bistable divides by 2. IC3a outputs are used to operate f.e.t. switches IC4c and d in antiphase in

the loop phase discriminator in the main loop. Similarly, IC3b operates switches IC4a and b in antiphase in the check loop discriminator. Thus four output signals are available with $90^0$ phase shifts; the antiphase drive signals for one discriminator being in quadrature with the antiphase drive signals for the other.

231. A mean positive level results from the check phase discriminator when lock is correct, and a zero or negative level for an incorrect lock (see Table 11). For the latter condition, comparator IC5a forward biases D3 causing the OUT OF LOCK l.e.d. D1 to illuminate, switches TR5 on and switches TR6 off. Switching TR6 off starts relaxation oscillator IC5d which produces a 10 Hz triangular waveform. The output from the search oscillator is buffered and amplified by IC5c before passing it out to sweep the v.c.o. on AB5. When TR5 is switched on it, in turn, switches TR4 on to reduce the loop gain during the search operation. A 0.3 µs delay is introduced by R18,R19 and C20 to provide sufficient time for the loop to achieve complete lock.

232. The check phase discriminator output is positive for correct mixer operation, but negative when the master oscillator is incorrectly higher in frequency than the slave (see Table 11). During the fault condition the out of lock condition is also detected causing f.e.t. TR4 to be switched on. This shorts C13 so that IC5b acts as an amplifier and inverter for the negative output from the phase detector. The resulting positive signal is fed to the PLL CONTROL line and prevents lock being achieved by the slave v.c.o. until sufficient negative voltage has been applied by the search oscillator to shift the slave to about 1 MHz above the master. During normal operation switch TR4 is off and IC5b acts as an integrating loop filter.

TABLE 11 DETECTOR OPERATION - AB6

| Loop signal/AB2 phase | $+90^0$ | $0^0$ | $-90^0$ |
|---|---|---|---|
| Mean loop phase discriminator output voltage | -ve | 0 | +ve |
| Mean check phase discriminator output voltage | 0 | +ve | 0 |

## Board AB7 - Oscillator select

Circuit diagram : Chap. 7, Fig. 17

233. This board operates as a single-pole three-way switch to enable three oscillators to be counted using only one counter. Inputs to the board are sinewaves from the interpolation oscillator on AB2, the l.f. master oscillator on AB3 and the cavity oscillator on AA6 after division by 16 on AA12. In order for the YIG tuned oscillator to be checked by the counter, input is taken from the cavity oscillator which is harmonically phase locked to it so that, after division by 16, the frequency is brought low enough to be acceptable to the counting circuit.

234. All of these signals are part of the first l.o. system and need to be counted when each of the oscillators is free-running so that the start

frequency of a sweep can be accurately determined. Thus AB7 and the counter on AD38 form a feedback system controlled by the microprocessor. The system uses count information to control D/A conversion values which shift the v.c.o. frequencies to the required start values. In a similar manner the sweep gain is checked by outputting the sweep voltage to set the swept oscillator at the frequency corresponding to the centre of the screen. Once again, count information is used in an iterative process to adjust the sweep gain D/A to set up the centre of screen frequency.

235. TR1 and 2, TR3 and 4, TR5 and 6 form converter stages to amplify the input signals from AB2, AB3 and AA12 to t.t.l. levels. The three signals are then fed to OR-gates IC1a,b and c for gating with the oscillator select COUNT lines from AB1. When the required line is taken low by the microprocessor selection logic, the appropriate input signal is passed to NAND-gate IC2, with the remaining OR-gates being inhibited by the action of the associated pull-up resistors. With two of its inputs held high, IC2 is enabled and the selected oscillator input is passed out as a squarewave to the frequency counter on AD38. C10 to C12 remove any noise from the control lines.

## Board AC1 - 50 MHz crystal oscillator

Circuit diagram : Chap. 7, Fig. 22

236. This board contains a low noise 50 MHz crystal oscillator phase locked by AC6 to a 10 MHz t.c.x.o. which provides long-term stability. The phase locked loop has a very narrow bandwidth to reject any noise or spurious sidebands on the t.c.x.o. and this is achieved by dividing down the two phase locking signals on AC6.

237. TR1,TR2 form the varactor controlled crystal oscillator whose low noise +11.5 V power supply is provided by regulator IC1. D5 at the +15 V input prevents current flowing to other boards. The error signal on the VARACTOR CONTROL line from AC6 supplies the control voltage for varactor diodes D1 to D4. Oscillator frequency is set by L3 and peak gain at 50 MHz is set by L2. Emitter followers TR8 and TR7 at this point supply local oscillator inputs for the mixers on boards AC2 and AA10 respectively. Four isolating amplifiers follow: TR4,TR5 feed to AB4 while emitter follower TR9 feeds via TR13 to AE1, and via TR10 to AA4 as well as via TR11 to the sampling gate on AC6 supplying the oscillator control voltage.

## Board AC6 - Phase detector

Circuit diagram : Chap. 7, Fig. 30

238. TTL drivers TR3,TR4 connect the 50 MHz input from AC1 to divider IC9 whose 10 MHz and 5 MHz outputs at this point are taken to AD2 and AC4,AK13 respectively. The 10 MHz from IC9 is further divided by 60 by IC7 and IC8 and the result integrated by IC1. A sampling gate follows consisting of f.e.t. switch TR2 and voltage follower IC2a. TR2 switching is controlled from AD4, either by an internal 10 MHz t.c.x.o. or an external 1,2,5 or 10 MHz reference. This input is fed to ICs 5 and 6 which perform division by 120 and the result is used to clock monostable IC4. 300 ns negative pulses from the pulse generator switch on TR1 which in turn switches on TR2 to store the instantaneous output from IC1 in sample and hold capacitor C4. Sampling gate

output is taken via amplifier and loop filter IC2b to the varactor diodes on AC1 so controlling the frequency of the v.c.x.o. In order to provide an out of lock indication, the signal from IC2a is fed to the out of lock detector formed by IC3. For an out of lock condition, the input to pin 3 of comparator IC3a exceeds the reference voltage set by potential divider R9,R10 causing voltage follower IC3b output to go high. This sets the REF UNLOCKED FLAG which causes an appropriate warning to be displayed on the screen.

## Board AD4 - 10 MHz standard

Circuit diagram : Chap. 7, Fig. 38

### Functions

239. This board performs the functions summarized below :-

(1) Provides the master 10 MHz reference to AC6 for the 50 MHz phase locked loop.

(2) Is able to accept a voltage from the back panel potentiometer and use this to adjust the 10 MHz reference to compensate for long-term drift.

(3) Detects the presence of an external standard input of >50 mV p-p and substitutes this for the internal 10 MHz standard.

(4) On detecting the external standard, sets the EXT STD flag.

### Standard selection

240. The internal standard is provided by temperature compensated crystal oscillator (TCXO) X1. Adjustment in the range ±50 Hz is provided by varactors D1,2,3 and potentiometer R1 via low-pass filter R2,R3 and C1. To compensate for long-term drift this adjustment can be over-ridden by a back panel potentiometer which gives the same range and is normally isolated by a ganged switch. Oscillator output provides one of the two inputs to dual line receiver IC1. When required, an external standard of 1,2,5 or 10 MHz provides a second input to IC1 and this is applied to pin 12. These signals are converted to t.t.l. by IC1 and the external standard passed on to the p-p detector formed by C6,D4,D5,C7,R11 and one Schmitt NAND of IC2. If the upper level of the external standard output from IC1 exceeds about 2.6 V the external standard is selected in preference to the internal one. In this case, the p-p detector takes IC2 pin 11 low and this is applied to IC1 pin 5 to inhibit output from the internal standard as well as being used to set the EXTERNAL STANDARD FLAG by taking it low. The selected standard is fed from IC2 pin 6 to board AC6.

## Board AE1 - 50 MHz calibrator

Circuit diagram : Chap. 7, Fig. 44

241. This board accepts a 50 MHz input from 50 MHz xtal oscillator board AC1 and derives from it two sinewaves of an accurate -10 dBm. One output is used in the calibration of the receiver signal path, the other feeds to the front panel STD 50 MHz OUTPUT socket.

### Amplifier

242. A 50 MHz input on the 50 MHz DRIVE 0 dBm line from AC1 is taken to the two-stage common emitter amplifier formed by TR1 and TR2 with the second stage tuned to 50 MHz. Nominal gain is 16 dB and the output at 4 V p-p splits into two. One path goes to the STD 50 MHz OUTPUT socket, the other feeds to the sinewave calibrator.

### Sinewave calibrator

243. TR3 and TR4 are switching transistors in the sinewave calibrator which produce a sinewave at a fundamental level of -10 dBm. This is a standard emitter coupled non-saturating switch circuit with the constant emitter tail current being channelled to either TR3 or TR4. Voltage regulator IC3, connected as a constant current sink for the long-tailed pair, provides a very accurate output over the temperature range 0 to 70 C. In this IC the voltage between terminals ADJ and VOUT is always 1.25 V. By adjusting the resistance across these terminals using potentiometer R20 the current can be accurately set. IC3 output is enabled when TR5 in the emitter path is switched on by the ENABLE line going high. The calibrator is followed by the low-pass filter formed by L3,C11,L4,C12,L5 which attenuates harmonics to better than -35 dBc.

### Output switch

244. Diodes D5,D6,D7,D8 driven by IC2 via R21,R22,R23,R24 form the output switch for the calibrated output to AG1. When the instrument is to be calibrated, ENABLE is taken low from AB1 to the inverting and non-inverting inputs of comparators IC2a and IC2b. This biases diodes D5 and D7 on and the signal is passed out with only a small insertion loss. When the instrument is in the input mode, ENABLE is taken high and the bias is reversed. This attenuates the signal while switching TR5 off to disable the sinewave calibrator.

### Automatic gain control

245. Amplifier output is fed back for automatic gain control to IC1a and IC1b. The detector circuit is formed by C21 and D2 which shifts the a.c. signal below 0 V. D2 and D3 are batch matched, with D3 providing temperature compensation. The resistors at the inputs to differential amplifier IC1a plus stray capacitance filters out the 50 MHz signal so that the output is a negative voltage. This is then compared with a voltage reference by integrator IC1b which has a time constant of 10 ms. The voltage reference is derived from the divided output from Zener diode D4 and set by potentiometer R40. The resulting output voltage from IC1b is then applied for gain control to pin diode D1 which is shunting R5, the emitter resistor for the first amplifying stage.

Standard output

246. Output from the amplifier, besides going to the calibrator, also goes to the front panel STD 50 MHz OUTPUT socket. It does so via resistor divider R11,R12 so that -10 dBm (70 mV r.m.s.) will be delivered to a 50 ohm load connected to the output.

## Board AJ1 - 1st l.o. power splitter

Circuit diagram : Chap. 7, Fig. 59

247. This board takes the 4.9026 to 9.1026 GHz ouput from the YTO and splits it equally between receiver block AH and the YIG block AJ. The circuit consists of an octave band Wilkinson power divider centred at 7 GHz, and provides a degree of isolation between the receiver and tracking generator i.f. paths. All elements are fabricated in microstrip on alumina. Outputs are to AH6 and AJ2.

## Board AJ2 - 1st l.o. amplifier

Circuit diagram : Chap. 7, Fig. 77

248. AJ2 is one of 3 identical boards; the others are AH6 and AK6. They are all identified as AL1 in Chap.6, Replaceable Parts and Chap. 7, Servicing Diagrams. The board takes the 4.9026 to 9.1026 GHz output from the YTO, amplifies it by 9 dBm, and passes it out via a 3 dB pad to power splitter AJ3. TR1, TR2 and TR3 are GaAs f.e.t.s whose bias is supplied from AJ8 which operates on the principle of varying the gate voltage to achieve a desired gain current. AH12 also provides protection for the f.e.t.s.

## Board AJ3/1 - 1st l.o. power splitter

Circuit diagram : Chap. 7, Fig. 60

249. This board takes the 4.9026 to 9.1026 GHz output from amplifier AJ2 and splits it between tracking generator block AK and sampling gate board AJ4. The circuit consists of an octave band Wilkinson power divider centred on 7 GHz. The board also provides a degree of isolation between the receiver and tracking generator i.f. paths. A 12 dB pad consisting of two 6 dB pads in series improves isolation and adjusts the levels to suit the outputs. Attenuators are of distributed type rather than lumped pi or tee. All elements are fabricated in microstrip on alumina.

## Board AJ4/1 - 1st l.o. sampling gate

Circuit diagram : Chap. 7, Fig. 61

250. Board AJ4 contains the sampling gate which is used to phase lock the YIG-tuned oscillator (YTO) to a harmonic of the input signal during narrow sweeps (i.e. less than 500 kHz/div). It also operates in the reverse direction to lock the cavity oscillator to the YTO to enable the YTO frequency to be set and measured on free-running sweeps (i.e. 5 MHz to 4.2 GHz).

251. The input at 256 to 275 MHz from AJ5 to step recovery diode D3 produces a pulse which is reflected back from the terminating resistor. From the balun the resulting pulses of opposite polarity are coupled by C1,C2 and used to switch D1,D2. The second input to the board is at 4.9026 to 9.1026 GHz from the 1st l.o. power splitter AJ3. When within the 1 MHz bandwidth of the circuit the loop locks and d.c. outputs are fed to YTO driver board AJ6.

**Board AJ5 - Sampling gate driver**

Circuit diagram : Chap. 7, Fig. 61

252. The input from cavity oscillator buffer board AA6 is a 512 to 550 MHz signal at a level of 0 dBm. This is terminated by R1 and then fed to IC1. IC1 is an e.c.l. divide by 2 circuit providing anti-phase outputs in the frequency range of 256 to 275 MHz. These outputs are summed using transformer T1 and then amplified by a two-stage common emitter amplifier formed by TR2 and TR4. Each stage of amplification is similar in operation, with active bias stabilisation being provided by TR1 and TR3. Output at a level of +20 dBm is fed to the sampling gate on board AJ4.

253. Transistor switches on AJ8 control the +15 V and -5 V supplies to the board. These enable the sampling gate driver to be turned off during free-running sweeps. This prevents unwanted beat notes between the cavity oscillator harmonics and the YTO from getting onto AJ6 and modulating the YTO, giving unwanted sidebands.

**Board AJ6/1 - YTO driver &**
**Unit AJ7 - YTO**

Circuit diagram : Chap. 7, Fig. 62

254. Board AJ6 provides the interface between the sweep and reference drives and the YTO, it also contains the low frequency part of the YTO phase locked loop. The YIG tuned oscillator operates in the range 4.9026 to 9.1026 GHz and forms the 1st l.o. of the instrument which is used in three principal modes :-

Wide sweeps (100 MHz to 4.2 GHz): Swept using the main coil. This has a sensitivity of 20 MHz/mA. The reference frequency voltage determining the start frequency of the sweep and the sweep itself are controlled by D/A converters on AB1.

Mid-range sweeps (5 to 50 MHz): Sweep drive is from the f.m. coil. This has a sensitivity of 300 kHz/mA (i.e. lower than that of the main coil). The reference frequency voltage is to the main coil.

Narrow sweeps (50 Hz to 2 MHz): In this mode the YIG oscillator is normally phase locked to the cavity oscillator. The reference frequency voltage goes to the main coil and sets the required frequency to within +/- 50 MHz. The f.m. coil drive is then used in a phase locked loop to lock the YTO frequency to a harmonic of the synthesizer and the cavity oscillator is swept over the range f = span/N, where span = instrument setting and N = harmonic number of the lock. This results in the f.m. coil sweeping over the required range whilst remaining locked to the cavity oscillator.

255. YTO output is also fed to the sampling gate on AJ4, the resulting signal being used in three ways :-

(1) To provide phase lock through a wide bandwidth loop via the f.m. coil drive.

(2) To maintain the reference drive level, when it is removed after lock has been achieved. This is done via a high gain narrow bandwidth phase locked loop using the main coil drive circuit.

(3) To count the YTO frequency during lock-down mode. This is achieved by reversing the normal action of the phase locked loop and locking the cavity oscillator to the YTO, then by counting the cavity frequency and knowing the harmonic to which the YTO is locked, its frequency can be calculated.

Data lines

256. The board performs a number of functions by means of f.e.t. switches which are controlled by the logic levels on data lines D1 to D3. Sweep main coil is selected by the combination D1 = low, D2 = high. The functions performed are shown in Table 12, and overall operation is summarised in Fig. 13.

TABLE 12 DATA LINE FUNCTIONS - AJ6/1

| DATA LINE | FUNCTION LOGIC | |
|---|---|---|
| | HIGH | LOW |
| D1 | Sweep f.m. coil | No f.m. coil sweeps |
| D2 | Ref. V to main coil<br>Open YTO loop<br>Search osc. off | Remove ref. voltage<br>Close YTO loop<br>Search osc. on |
| D3 | Slug main coil | Full main coil bandwidth |

Main coil driver

257. The YTO main coil driver consisting of IC2 and TR11 forms a voltage-controlled current source. Three inputs are summed into the inverting input of op-amp IC2, these being the sweep, reference and offset voltages. Offset voltage, supplied by voltage regulator IC10, is required to provide the initial current in the main coil to set the YTO to just below its minimum frequency. IC2 output is taken to Darlington transistor TR11 which is used to provide sufficient current drive to the main coil. The coil current is sensed by off-board resistor R1, with the feedback provided by R12 setting the overall voltage gain to 0.27.

258. Under certain circumstances, e.g. when the f.m. coil is being swept or used in the locked mode, additional feedback provided via 'slugging' capacitors C15,C16 is switched into circuit to reduce the main coil bandwidth and sensitivity to noise. For this purpose, f.e.t. switches TR2 and TR14, which complement each other, are controlled by the logic on the D3 SLUG MAIN COIL line from AB1. When D3 is taken high, level shifters IC7a and IC7b respectively close TR14 and open TR2 to form the feedback path.

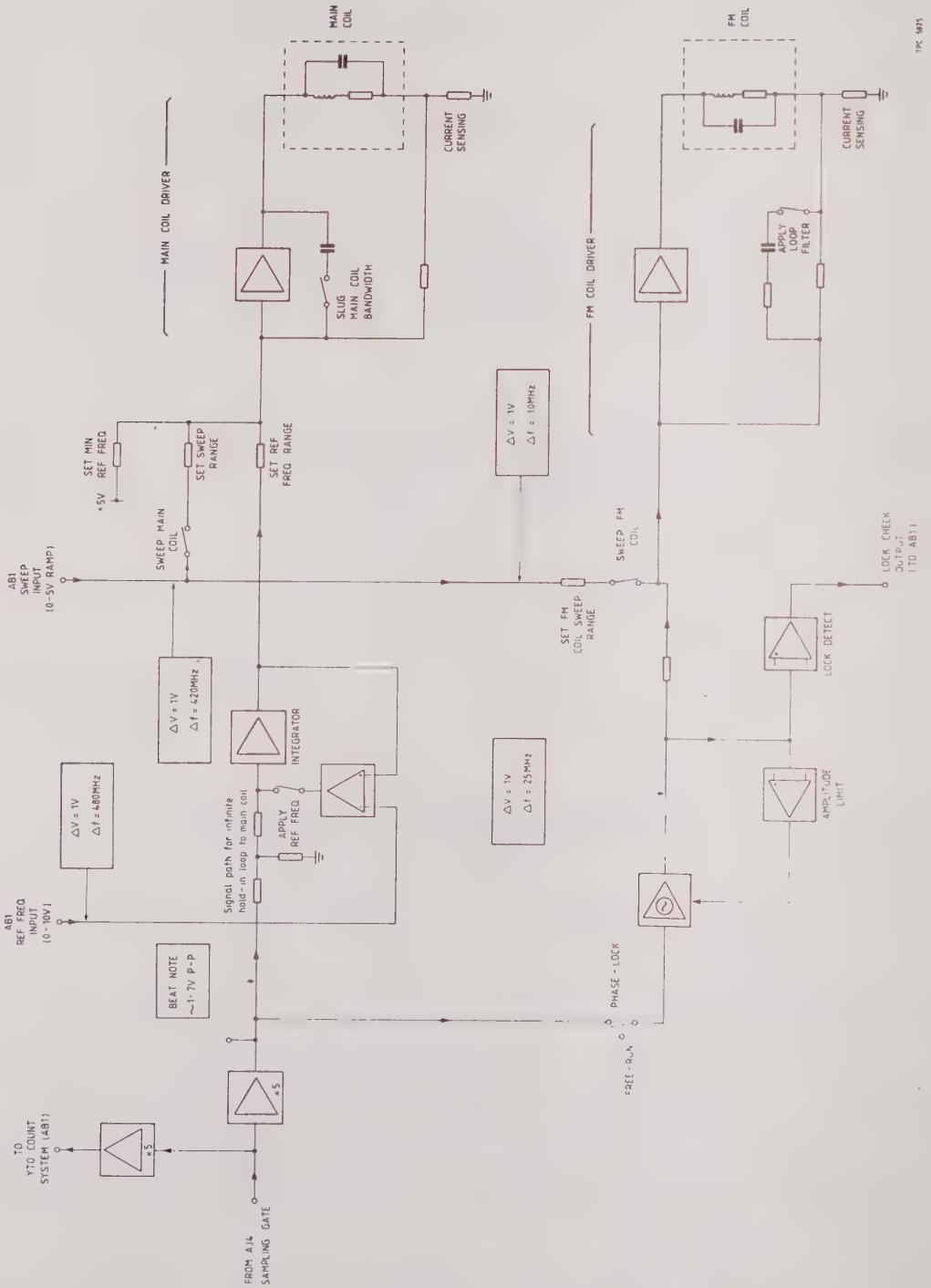


Fig. 13 YIG-tuned oscillator operating summary - AJ6/1.

FM coil driver

259. The f.m. coil driver is formed by IC5 and TR8 to TR10. Two inputs are summed into the inverting input of op-amp IC5, these being the sweep and phase lock voltages with only one being active at a time. TR8 to TR10 form a push-pull amplifier to drive the f.m. coil, with the current being sensed by R45,R56 with R57 providing the feedback resistor for the amplifier. C20 provides gain roll off at frequencies greater then 30 kHz.

Reference frequency input

260. The REF FREQ INPUT at PL4 originates from AB1 is applied only to the main coil. It is controlled by the D2 REF TO MAIN COIL line via level shifter IC8d and switch TR13. During wide- and mid-range sweeps TR13 is switched on. This allows the inverting input of IC1a to be driven via comparator IC1b so that the output at TP4 is equal to the REF FREQ INPUT voltage. This establishes the start frequency of the sweep.

Sweep input

261. Also present during wide- and mid-range sweeps is the SWEEP INPUT at PLA6 which originates from AB1. It is gated to either the main or f.m. coil by TR1 or TR6 respectively. Data lines D1 SWEEP FM COIL and D2 REF TO MAIN COIL determine which of the YTO coils is swept. Switch drive and decoding are performed by IC8a, b and c.

Narrow sweep operation

262. When performing narrow sweeps with the YTO locked to the cavity oscillator, the reference frequency is first set by driving the main coil to within +/- 50 MHz of the required frequency. The main coil is then 'slugged' by switching TR2 on and TR14 off via data line D3. Data line D2 is also taken low, turning TR5 on and TR3 off (via TR4). This enables IC4 to act as a Wien bridge oscillator with a frequency of 60 Hz. The oscillator is amplitude limited via window detector IC6c,IC6d and switch TR3 to sweep the f.m. coil +/- 50 MHz.

263. Output from sampling gate board AJ4 at a bandwidth of 1 MHz enters at PLC and is amplified by IC3b with a gain of 5. IC3b output goes to op-amp IC4 inverting input via loop switch TR5. As well as performing the function of search oscillator IC4 also has a forward gain of 3, its output going to the f.m. coil driver stage. TR7 is switched off to bring into circuit the loop filter formed by R43, C19, C30 and R44.

264. As the search oscillator brings the frequency of the YTO to within the acquisition range of the loop, phase lock is achieved and the loop gain is such that further operation of the search oscillator is suppressed.

265. Should, through any circumstances, the loop lose phase lock the search oscillator will start to run again. This is detected by a similar window detector to that used for limiting search width but which has a narrower window. This is IC6a,Ic6b and when loss of lock is detected it will cause, via TR12, l.e.d. D2 to flash and also to pulse the LOCK CHECK OUTPUT line PLA7 to AB1.

266. When the loop is phase locked, a second circuit path is fed from IC3b. This maintains the reference frequency drive voltage when the REF FREQ INPUT

voltage is removed by switching off TR13, thus allowing the reference drive to be used to adjust the UHF synthesizer frequency. Any drift in the YTO frequency will result in a change in d.c. level at the output of the sampling gate and hence at TP1. IC1a integrates the signal level change and applies it to the main coil via the reference input thus causing the sampling gate output to return to zero volts at TP1. Hence IC1a acts as a loop filter providing a very narrow bandwidth phase locked loop driving the main coil. Potentiometer R21 is used to cancel sampling gate offset and is adjusted to set the d.c. voltage at TP1 to 0 V.

Frequency counting

267. When the YTO frequency is being counted during lock-down mode, the main coil can be either slugged or left at full bandwidth depending on the sweep width selected, the search oscillator is switched off and the YTO loop is open. The cavity oscillator frequency is then changed until a harmonic of its frequency causes a signal to appear at the sampling gate output. This is amplified by IC3a and fed via PLA5 to the lock-down loop on AB1.

Sweep mode selection

268. The sweep modes selected by the logic levels on data lines D1 to D3 together with the operation of the f.e.t. switches are shown in Table 13.

TABLE 13 SWEEP MODE SELECTION - AJ6/1

| SWEEP MODE | DATA LINES | | | TRANSISTOR SWITCHES | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | D1 | D2 | D3 | TR1 | TR2 | TR3 | TR4 | TR5 | TR6 | TR7 | TR13 | TR14 |
| Wide (main coil) | L | H | L | ON | OFF | ON | OFF | OFF | OFF | ON | ON | ON |
| FM coil | H | H | H | OFF | ON | ON | OFF | OFF | ON | ON | ON | OFF |
| Phase locked | L | L | H | OFF | ON | OFF | ON | ON | OFF | OFF | OFF | OFF |
| Count YTO (wide) | L | H | H | ON | ON | ON | OFF | OFF | OFF | ON | ON | OFF |
| Count YTO (narrow) | H | H | H | OFF | ON | ON | OFF | OFF | ON | ON | ON | OFF |

Regulators

269. Two power supply regulators are contained on the board, IC9 provides a -5 V supply from -15VLC to power the YTO maintaining circuit, whilst IC10 provides the offset voltage to the YTO main coil driver with a nominal output of 5 V.

## Board AJ8 - 1st l.o. bias board

Circuit diagram : Chap. 7, Fig. 63

270. Board AJ8 supplies bias, power and control information to the AJ local oscillator block.

Interfacing

271. One of the functions of this board is to provide an interface between D-A board AB1 and YTO driver board AJ6/1. Supply lines are decoupled using electrolytic capacitors, while data and signal lines are decoupled with

resistor,capacitor networks. Of these, the network supplying the lock-down signal which is used to lock the cavity oscillator to the YTO (so that the latter can be counted), has a much shorter time constant so as not to introduce an excessive amount of unwanted phase shift into this path.

Sampling gate drive disable

272. Circuitry around TR1, TR2 and TR3 switches the +15 V and -5 V supplies to AJ5 sampling gate driver. This allows AJ5 to be turned off during free-running sweeps and prevents unwanted beat notes between the cavity oscillator harmonics and the YTO from getting onto YTO driver board AJ6 and modulating the YTO, giving unwanted sidebands. When the DISABLE SAMPLING GATE DRIVE line is t.t.l. high (there is a pull-up resistor on AB1), TR1 is turned on, which turns on TR2 and TR3 which saturate so that virtually the full supply voltage appears on AJ5.

FET bias supply and protection

273. FET bias regulation is provided by a voltage reference, three similar bias stages and a supply rail sequencing stage. The voltage reference section is based on a potential divider which sets the drain voltage to 8.2 V. The junction of R14,R16 is set to 10.2 V by the resistor values, and this potential is buffered by IC1a. These two voltages can be monitored at TP1 and TP2 respectively.

274. The supply rail sequencing is done by the circuit around TR4,IC1a. The aim of this circuit is to protect the GaAs f.e.t.s from incidents where the +15 V rail appears on the board before the -5 V supply. In such a case, the gate would be at ground with drain volts present, and large, potentially destructive drain currents would flow. The circuit operates as follows: If the -5 V supply is absent, TR4 conducts, pulling down the drain supply. Then when the -5 V supply appears, 4.3 V Zener diode D1 conducts, holding off TR4 and giving full drain supply.

275. There are three similar bias stages, all fed from the voltage reference section, only one of which will be described. The circuit is designed to fulfill the following aims:

(1) Provide GaAs f.e.t. bias (8 V drain voltage at 45 mA nominal drain current)

(2) Provide protection for the GaAs f.e.t.s and the bias components on the board when the gate feedthrough capacitor connection is missing, or a short to ground occurs on either the gate or the drain feedthroughs.

276. The positive supply which feeds the drain current comes from TR10 emitter. IC1b provides high impedance buffering to the 10.2 V reference via R23, and feedback ensures that TR10 emitter is at 10.2 V. 3 V Zener diode D3 in the collector of TR10 reduces the transistor dissipation, and keeps this to a safe value in the event of a short on the drain feedthrough capacitor. R24,R25,R26 set the drain current, a parallel combination being used to avoid over-dissipation in the event of a drain short. If excessive drain current flows, the voltage across the current-setting resistors rises. When the voltage across R25 reaches 0.7 V, TR9 conducts, pulling down the drain supply voltage, limiting the drain current to 80 mA and the voltage on TP3 to about

3.5 V. The higher the temperature, the lower the current at which the protection circuit will start to cut in.

277. Drain voltage stabilisation is provided by a negative feedback circuit around TR5, TR6 and TR8. TR5 and TR6 form a long-tailed pair which compares the drain voltage with the 8.2 V reference and feeds an error signal to the f.e.t. gate. The action of the negative feedback is to provide gate bias to bring the drain voltage to 8.2 V, with an error caused by the difference in base voltages between the two transistors. TR8 provides the current required for the gate bias of the f.e.t. amplifier. Although GaAs f.e.t.s are high input impedance devices and require negligible gate current, the gates are shunted by 200 ohm resistors which provide a match at 4.9 to 9.1 GHz. Since TR8 is a common emitter amplifier with the collector load resistor grounded, the f.e.t. gate cannot be taken positive. If the gate connection is shorted to ground, with the highest current gain device for TR8, this transistor could over-dissipate. To prevent this TR7 robs TR8 of base current when the emitter current of TR8 exceeds 35 mA, limiting TR8 dissipation to about 150 mW (again the protection cuts in earlier at higher temperatures). The gain of the feedback is rolled off stably by C11.

## MICROPROCESSOR AND CONTROL

278. Inputs from the variable control on AZ2 and the keyboard AF1 are applied to latches on AF2. Any change in this data due to movement of the control or to a key being pressed is detected on this board and results in a processor interrupt on AD38 (see Fig. 14). The processor responds by latching the amended data onto the quiet data bus during a read cycle. Similarly, interrupts occur due to movement of the variable controls on the two AZ1 boards but not until the direction of movement has first been resolved on AF2. Other processor interrupts are caused by an input attenuator overload, and end of sweep, as well as for controlling the transfer of serial housekeeping data between the r.f. and display units. Servicing of all interrupts is organized by a Real Time Executive residing in the main program held in EPROM.

279. Data transfer between the microprocessor and the memory, status register and frequency counter is by means of the µP data bus. The memory bank consists of 160 K of EPROM holding the main program, 4 K of EAROM to store the current instrument settings when the instrument is switched off and 8 K of RAM for scratch pad operations. The 8-bit status register holds the r.f. unit address in three bits. Two bits convey instrument temperature information. A further two bits indicate when an external standard is connected and when the internal one is uncalibrated. The final bit indicates when an optional tracking generator is fitted. The frequency counter on AD38 is used to monitor the oscillators during frequency setting operations. Data transfer for switching, control and flag reads is via a 2-way buffer between the µP data bus and the quiet data bus. The buffer prevents processor activity from spilling over onto the quiet bus to prevent possible analogue interference.

280. Housekeeping data is conveyed between r.f. and display units by the 20 mA current loop on AR1. This board also feeds serial display data accompanied by synchronizing pulses for serial to parallel conversion to the display unit. It also holds the audio amplifier used for monitoring purposes and contains the instrument temperature sensor. The associated board AR2 contains the cooling fan speed controller and the r.f. unit power supply interface. Power is supplied from the display unit to the regulators and line cleaners on this board as well as to AA11.

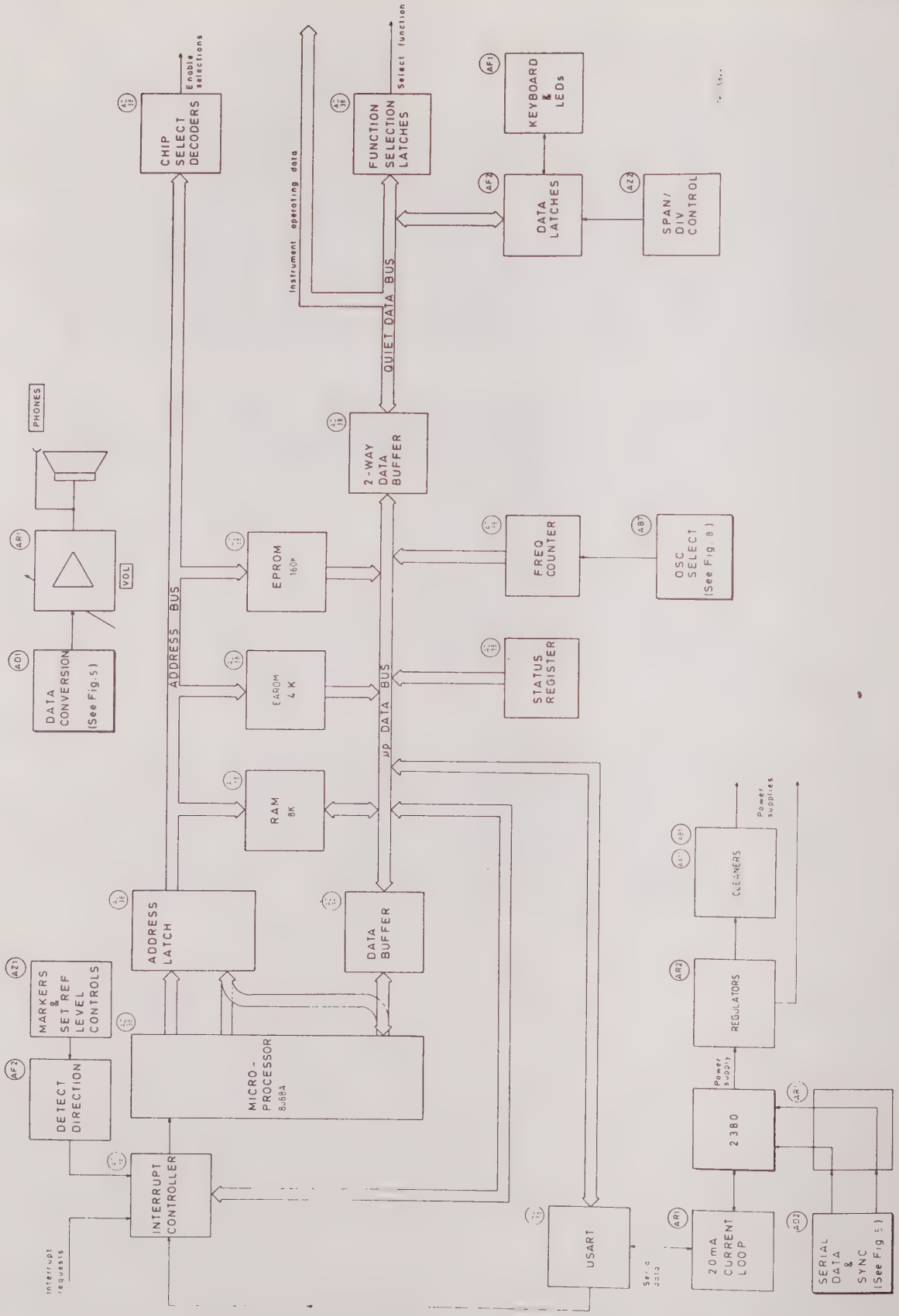


Fig. 14 Microprocessor & control block diagram showing main functions of boards.

## Board AA11 - Line cleaner

Circuit diagram : Chap. 7, Fig. 10

281. The purpose of the line cleaner circuits on this board is to remove any low frequency a.c. component on the d.c. supply lines. The line cleaners operate on a feedback principle. Ripple voltage at the line cleaner output is compared with a quiet reference and an error current is generated. The voltage developed by this current across a resistor in series with the supply rail is equal and opposite to the applied ripple component. In this way, the ripple voltage at the input is cancelled and the output is ripple-free. All the line cleaners operate similarly to the +15 V one described in detail below.

282. The +15 V line cleaner consists of differential amplifier IC1 and current driver TR1 which operate in a feedback system. IC1 controls TR1 which provides the current drive with a standing value of 40 mA. The system maintains the a.c. component on C5 (i.e. the +15V LC ripple content) at the same level as the quiet ground reference on C1. Any ripple on the +15V LC output is sensed by R4,R5 and fed via C5 to IC1 as an error signal. This causes the inverting input of IC1 to go more positive increasing p.n.p. TR1 conduction to bleed away the extra current so restoring the original level. IC1 output voltage thus constrains the TR1 emitter current flowing through R4,R5 to cancel the ripple component.

283. Feedback also controls the d.c. standing voltages. These are stabilised with the voltage on IC1 non-inverting input (determined by potential divider R1,R2 between +15VB and TR1 collector) equal to the voltage on IC1 inverting input (determined by divider R31,R32).

284. R3,C1 form a low-pass filter with very low cut-off frequency so that ripple components down to 5 Hz do not disturb the quiet ground reference on the IC1 non-inverting input. D1 speeds up settling time at switch-on by enabling C1 to quickly attain the reference level. D20 provides 8.2 V Zener drop which reduces TR1 dissipation.

285. The +5V line cleaner operates similarly to the +15V one except that the Zener dropper and input potential divider are not required. The -5 V line cleaner is similar to the +5 V one except that it is a voltage mirrored version. Since the negative voltage regulators on AR2 have less ripple suppression at 120 kHz, the -15 V cleaner on board AA11 has an additional stage to provide extra current drive at this frequency. This is provided by TR5 whose collector current increases as emitter load impedance goes low at the series resonant frequency set by L1 and C13.

## Board AD38 - Microprocessor

Circuit diagram : Chap. 7, Figs. 39 to 42

286. The microprocessor and associated circuits are described in the order in which they appear in the circuit diagram.

### Frequency counter (Sheet 1)

287. The frequency counter on this board is used as part of the frequency setting process to measure the settings of the cavity v.c.o. on AA6, the

interpolation v.c.o. on AB2 and the l.f. master v.c.o. on AB3. The required oscillator output selected on AB7 is fed into the t.t.l. driver TR1,2 and used to clock 4-bit counter/latch IC14. To provide the gating period for this counter, a 10 MHz input derived from the 50 MHz crystal oscillator on AC1 is divided down to 2 MHz by IC5a then fed to the counter 1 section of IC26. The counter section is programmed to produce gating periods of 7.8125 ms for the cavity and l.f. master oscillators and 31.25 ms for the interpolation oscillator. The gating periods determine the measuring resolutions of 8.192 kHz for AA6, 128 Hz for AB3 and 32 Hz for AB2. Dividing AB2 output by 32 on AB6 sets the system accuracy to 1 Hz.

288. IC26 output provides the data input for retimer IC17a which, when clocked, opens IC2a to IC14 which then commences counting the clock input on pin 2. The counter m.s.b. output cascades into the 16-bit counter formed by IC26 section 2. At the end of the gating period, gate IC2a is closed and the latest count is held latched out to buffer IC15. When ready, the processor reads the 16 m.s.b. of the frequency from IC26 using CS10, and the 4 l.s.b. from buffer IC15 using CS20.

Clock signals

289. The 10 MHz input is also divided by IC5b and the resulting 5 MHz directly provides the clock input for a number of counters.

CLK TIK signal

290. The 2 MHz is counted by a ÷20,000 section of IC26 to produce the 10 ms CLK TIK interrupts. This function is required by a suite of software referred to as the executive. One of the routines within the executive is capable, by means of CLK TIK, of delaying the execution of a task for any multiple of 10 ms. Other routines organize the tasks into two queues of high and low priority. When all high priority tasks have been executed the executive will continue with any low priority tasks that may be queued. At any point throughout this procedure, high or low priority tasks may be transferred from the delay queue to the end of the respective priority queue to await execution.

BAUD RATE CLOCK signal

291. The 5 MHz clock signal is successively divided by 2 by IC6a and IC7a then divided by 8 by IC7b and the resulting 156.2 kHz provides the BAUD RATE CLOCK for the USART IC27.

Non-linear sweep generator

292. This provides compensation for the non-linearity of the voltage controlled oscillators' frequency/voltage characteristics. The generator consists of 3 counter sections of IC26. The first section varies the correction gradient, the second provides an adjustment for the different sweep speeds while the third stores the number of clock periods to the next gradient change. This correction process is heavily dependent on software. On the occurrence of an interrupt signalling a breakpoint, the gradient is changed in the first section and the number of clock periods in the third section is adjusted in accordance with the stored voltage/frequency characteristic. Output from the second section is taken via t.t.l. driver TR3 to form the variable SWEEP CLOCK signal. This is fed to the D-A converter on AB1 so supplying a compensating non-linear sweep to the oscillators.

Display presentation/frequency mask counter

293. Counter Section 5 of IC26 is preprogrammed to interrupt the processor on any one or more of the 503 ordinates on the forward scan of the display. The counter enables accurate marker and negative start frequency adjustments to be made. For the latter purpose, the digital techniques used allow the generation of pseudo negative sweep frequencies. This facility is used for starting and stopping the sweeps when the instrument's frequency range is exceeded as well as for monitoring certain marker functions. It also allows a symmetrical display of the zero frequency point.

Sweep latches

294. Bus data from 8-bit latch IC16 provides a number of control signals. One output, to the SERIAL DATA O/P ENABLE line, enables the tri-state buffers on AR1 controlling the transfer of serial display data to the upper unit. A second output supplies the LOW POWER STANDBY signal to provide write protection for the EAROMs. A third opens gate IC3a to the AD2 SWEEP TRIG signal which is asserted low on the occurrence of a trigger pulse. Besides causing an interrupt it enables a further, 4-bit, latch IC4. One output from this latch, DISPLAY INHIBIT, is used to reset the PISOs supplying the display data on AD2. Two further outputs provide counter start signals for IC26.

Microprocessor (Sheet 2)

295. Central processor IC25 is an 8-bit Intel 8088A which uses a multiplexed data bus to accommodate the 20-bit address. This provides either 8 bits of the address or 8 bits of data. Output lines A8 to A19 carry either the high order memory address or the input/output (I/O) address with A16 to A19 low. Input/output lines AD0 to AD7 carry the low order memory or I/O address during the first clock cycle, and then carry data during the third machine state clock cycle. ALE (address latch enable) is used to differentiate between data and address; when it is taken high the contents of the data bus are treated as part of the address and latched out from IC35. IO/M is used to differentiate between an I/O and a memory address; when it is taken low the on-board memory is addressed. WR (write) and RD (read) asserted low enable the memory or I/O device selected by the address bus to be written into or read out from respectively. They also indicate that the data bus is available for the data transfer operation. DT/R (Data Transmit/Receive) is used to control the direction of data flow through the two data bus buffers; this line is taken low for a data read operation and high for a write operation.

296. The CLK, RESET IN and RDY inputs are supplied by clock generator IC18. This takes the 10 MHz input from AD2, internally divides it by 3, then feeds it from pin 8 to provide the processor CLK signal. The RDY output to the processor from pin 5 is synchronized with the CLK signal. Interface board AR1 supplies this IC's RESET input, with R15,C63 providing a power-on reset function. This signal is output from an internal Schmitt trigger to supply the processor RESET IN signal. The PLCK output on pin 2 is a t.t.l. level signal at half the processor CLK frequency which is used to provide the peripheral clock.

297. The 8088A has only 2 interrupt inputs, these are NMI (unused) and INTR which is active high. Interrupt request line INTR is connected to the master interrupt controller IC30 which handles all interrupt requests. The INTR input is sampled by the processor during the last clock cycle of each

instruction to determine whether to enter an interrupt acknowledge operation. When the processor acknowledges the interrupt by asserting INTA low, besides being sent back to all the interrupt controllers it is used to enable buffer IC34. This is to allow the processor to obtain the service routine address on the data bus.

Interrupt controllers

298. The master IC30 and the slaves IC28 and IC29 each manage up to 8 interrupt requests on lines IR0 to IR7. Interrupts are then asserted on the INT lines; to the master from the slaves, to the processor from the master. At initialization, IC28, IC29 and IC30 are enabled by chip select lines CS06, CS02 and CS00 respectively and, in conjunction with command select line A0, WR (write) is asserted low to allow the initialization commands to be written in on the data bus. Amongst its other functions the command configures the interrupt priority levels so that IR0 has the highest, and IR7 has the lowest, priority. At a later stage, RD (read) may be asserted low to read the status and then WR asserted to change the priorities or to mask off an interrupt request line.

299. When slave IC28 or IC29 receives an edge-triggered interrupt request on one of its IR lines, it sends an interrupt request to either the IR3 or IR7 input respectively of master Programmable Interrupt Controller (PIC) IC30. Unless engaged with a higher priority interrupt, IC30 passes on the interrupt request to the INTR input of the processor. At this, IC25 completes its current instruction then acknowledges the interrupt by sending a low INTA pulse. This sets buffer IC34 for data input and is applied to all PICs. On receipt, the master PIC addresses the appropriate slave using the CAS0,1,2 lines while sending a call instruction back to the processor. When it is received, the processor sends two further INTA pulses which enable the slave to release its preprogrammed address onto the data bus in the order low byte, high byte. The address contains a pointer to the area in memory holding the routine to service the interrupt.

Communication interface

300. IC27 is a USART (universal synchronous/asynchronous receiver/transmitter) operating at 9600 baud and performing asynchronous data control between r.f. and display units. It accepts data from the processor in parallel format and converts it into a serial stream for transmission to the display unit. Simultaneously, it can receive data from the display unit and convert it into parallel data for the processor. It is interrupt driven and signals to the processor whenever it can accept a new character for transmission or whenever it has received a character from the processor. The processor can read the status of the USART at any time.

Operation

301. At initialization, processor IC25 addresses IC27 by taking chip select line CS04 low then sets the control/data (C/D) line high and the write (WR) line low to send a set of control words on the data bus. These define the operating format. Subsequently, a high RESET pulse can force the USART into an idle state to enable a new set of control words to be written in.

302. Serial data is clocked in and out of IC27 at the 9600 Baud rate derived from the 156.25 kHz input to pin 9. Serial input data is assembled in a receive buffer within the IC and, when the character is complete, RXRDY pin 14

takes the IR1 line high to slave interrupt controller IC28 to request a processor interrupt. If, however, the assembled character is a Break instruction, it is BD pin 16 instead which requests the interrupt on the lower priority IR2 line. When ready to read the character, the processor addresses the USART using the CS04 line, then takes C/D and RD (read) low and accepts the data on the data bus.

303. When able to accept a character from the processor for onward transmission to the display unit, the USART takes TXRDY pin 15 high to request an interrupt on the highest priority (IR0) line to IC28. When ready with a character, the processor places the data on the bus, addresses the USART on the CS04 line, then takes the C/D and WR lines low. The character is accepted by a transmit buffer within the IC and then serially clocked out on the TX line to the display unit.

Memory banks (Sheet 3)

304. The operating program is contained in EPROMs (ultra-violet erasable programmable read only memories) IC41 to IC45 which provide a total of 160 K-bytes of memory. These are enabled by IC24 which decodes the address bus and is itself disabled by the IO/M line going high.

305. IC46 contains 8 K-bytes of RAM (random access memory) used for scratch-pad read/write operations. When the instrument is switched off the contents of this memory are lost. In the same bank are EAROMs (electrically alterable PROMs) IC39 and IC40 each of which also holds 2 K bytes of memory. These store the current instrument settings which are then remembered when the instrument is switched on again. The entire memory bank is enabled by IC12 which decodes A13 to A15 of the address bus. To prevent corruption of the memory contents, write enable for the EAROMs is gated by IC19d under the control of monostable IC47a.

Data direction control

306. The direction of data flow between the microprocessor data bus and the quiet data bus is controlled by two-way buffer IC21. This is enabled only when the A5 and IO/M lines are both high. Data direction is determined by the logic state of the DT/R line; for a read operation this line is taken low.

Chip select decoding (Sheet 4)

307. IC20 and IC31 are the master decoders providing the low enable signals for the chip select decoders. When enabled by the IO/M line being high and address lines A6 and A7 being low it decodes the A3 to A5 lines to produce 8 outputs. Two of these enable IC8a and b which decode address lines A1 and A2. The remaining decoders ICs 22,32,33,23,38 and 37 decode lines A0 to A2, and since their chip select outputs involve read/write operations they are additionally enabled by the RD + WR line.

## Board AF1 - Front panel keyboard

Circuit diagram : Chap. 7, Fig. 46

308. The front panel circuit is mainly a static encoder for the 46 push-buttons which are arranged at the nodes of the 8 x 8 matrix. The code used to represent each button is derived from its node address; columns are numbered 0 to 7 and rows are numbered 8 to F hexadecimal. The code used to represent each button is derived from its node address, as an example the LOG button is coded C2H. Columns feed directly to decoder IC3 while rows feed to decoder IC4 via the 9 elements of ICs 1 and 2. With no buttons pressed, all the comparators' inverting inputs are held low by the elements of R2 connected to ground, while the non-inverting inputs are held slightly high by the potential divider formed by R3, R4. Consequently, the inputs to row decoder IC4 are held high as are all the inputs to column decoder IC3 due to the action of pull-up resistors R1. When a button is pressed, it shorts together a row and column of the matrix. This forms a potential divider from the respective elements of R1 and R2 causing the appropriate input lines to be taken low to the decoders. These are 8 to 3 line decoders with IC3 and IC4 supplying the l.s.b's and m.s.b's of the button address respectively. Due to IC3 pin 5 being tied to ground, any input going low causes pin 14 also to go low and this feature is used to generate KEY PRESSED to AF2 for key debounce purposes. The PRESET button does not form part of the matrix but instead is connected to cross-coupled gate bistable, IC5.

309. The l.e.d's installed in many of the push-buttons have their anodes connected to the +5 supply and their cathodes separately driven via selection logic from AF2.

## Board AF2 - Front panel logic

Circuit diagrams : Chap. 7, Figs. 47 & 48

### Sweep speed control

310. When the SPAN DIV control is turned, it alternately makes and breaks with contacts on shaft encoder board AZ2. When it makes, it connects the ground on tag 1 AF2 to one of the 3 lines to IC7 pulling it low. When it breaks, all lines are taken high by pull-up resistors R1 to R3. Pin 5 of the 8 to 3 line decoder IC7 is tied to ground to enable the IC to detect when all are high. This occurs with the break condition which signals a SPAN DIV change, and pin 15 is taken low to initiate a processor interrupt. To prevent interrupts due to multiple contact closures the output from pin 15 is first of all taken to the debounce circuit formed by ICs 9 and 15.

311. The negative-going edge of the break signal to pin 1, IC9a triggers the monostable which produces a 500 µs negative-going pulse from pin 4. Bistable IC15a is clocked by the trailing edge of the pulse and its output pin 5 follows the IC7 low output. This sets IC15b pin 10 low as well as clocking IC9b pin 9. The latter action resets the IC to enable it to respond to the rising edge occurring at the end of the break signal when the new SPAN DIV setting is selected. When this occurs at pin 10 of IC9b, the monostable produces a 2 ms negative pulse. The rising edge at the end of the pulse clocks IC15b which takes pin 8 high so producing the required single rising edge on the HZ/DIV line to cause an interrupt.

312. As a result of the interrupt request, the processor takes chip select line CS47 low to read the data from buffer IC6. By comparison with the previous shaft position data the processor determines the direction of rotation of the SPAN DIV control and takes the appropriate action.

MOVE and REF LEVEL controls

313. The direction detectors for the MOVE and REF LEVEL variable controls both operate in a similar manner and each receives quadrature inputs from shaft encoding board AZ1. The detectors produce pulses on one of two output lines depending upon the direction in which the shaft is turning.

314. The following explanation is for the MARKER direction detector but the principle applies to both detectors. The output pulse trains from the encoder arrive at IC14b: let them be X to pin 4 and Y to pin 5. Y is used as the reference phase and is also connected to IC14a pins 1 and 2. When an edge occurs due to movement of the control, a delay is caused by R6 and C20 so that pins 1 and 2 are momentarily logically opposite. The trailing edge of the resulting narrow pulse triggers monostable IC13a whose output on pin 13 enables IC11b and IC11c with a window pulse of about 2 µs duration. If X leads Y, then IC14 pin 6 will always be low during the window period, and negative-going pulses will appear at output pin 6 of IC11. Conversely, if X lags Y, IC14 pin 6 will always be high during the window period, and negative-going pulses will appear at output pin 8 of IC11. The pulses from IC11b and IC11c will have the same duration as the window pulse but at twice the frequency of X and Y. The output of IC11c is used as MARKER DOWN (IR6), and that of IC11b as MARKER UP (IR5), when they are sent to the interrupt controller. An example of operation is shown in Fig. 15.

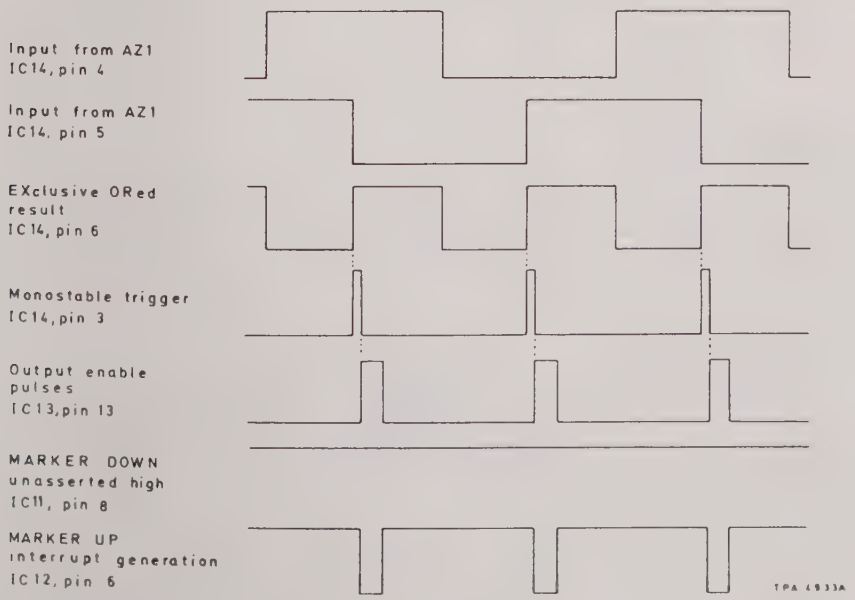


Fig. 15 MARKER direction detector operation. Example shows up movement - AF2.

Keypad

315. When a push-button on front panel keyboard AF1 is pressed, the inputs to AF2 consist of a negative-going signal on the KEY PRESSED line and the push-button identity on lines KD0 to KD6. The former signal is taken to the keypad interrupt debounce circuit while the latter is applied to latch IC1. The debounce circuit comprises dual multivibrator monostable IC10 and dual bistable IC8 and operates in a similar way to the HZ/DIV debounce circuit described under 'Sweep Speed Control'. Here however, the delay introduced when the key is depressed (make) is 5 ms and when released (break) is 20 ms. When KEY ON goes high to cause an interrupt, it also clocks IC1 which latches in the key identity. In response to the interrupt, the processor takes CS43 low to enable the IC1 tristate outputs to be placed on the data bus. After reading the identity of the key being pressed, the processor will also take one of the chip select lines CS42 to CS46 high to clock out the l.e.d. illuminating data if appropriate. KEY OFF also causes an interrupt; its main purpose is for use with the INTMD IDENT key when the processor inserts a 5 dB pad for the period during which the key is held depressed.

## Board AR1 - Signal interface

Circuit diagram : Chap. 7, Fig. 80

316. Board AR1 performs the following functions:-

(1) Interfaces between the r.f. and display units with respect to signal data and ASCII-coded messages.

(2) Provides a line cleaned +5 V supply for the crystal filters on AC4.

(3) Detects the overheat condition and causes the power supply to be shut down when the instrument gets too hot.

(4) Amplifies the detected fourth i.f. to drive a loudspeaker.

Unit address

317. The three UNIT ADDRESS lines from input socket SKS carry the r.f. unit address. At the display unit these lines are earthed, setting the address of the r.f. unit to zero. The address is fed out from PLA to the status buffer on AD38.

Data transfer

318. Current for both the RECEIVE and TRANSMIT 20 mA current loops, used for the transferrence of ASCII-coded housekeeping data between the r.f. and display units, is provided by a 20 V source and 1 kilohm resistor in the display unit.

319. For the display unit to transmit a logical '1' to the r.f. unit, it switches on the isolating transistor in opto-coupler IC6 causing a voltage to be developed across R24. And to transmit a '0', the isolating transistor is turned off so that no voltage is developed across the resistor. The resulting serial data at t.t.l. levels is sent on the RX line to the USART on AD38.

320. When the r.f. unit sends a '1' to the display unit, the high logic level on the TX line switches on TR3 which causes the isolating transistor in IC5 to switch off. In this condition, 20 mA flows through the loop via TR4 whose base current is supplied from 1 mA current regulator diode D3. When the TX line is taken low for a '0', TR3 switches off and the isolating transistor switches on so diverting the base current from TR4 which then switches off. The current is thus supplied by the isolating transistor but is limited to 1 mA by D3. This 20:1 current ratio meets the standard required for a 20 mA current loop.

Display data

321. Display data from the PISOs on AD2 on the SERIAL DATA line and synchronizing pulses on the SERIAL DATA SYNC line are fed through tristates IC4a and IC4b to the display unit when enabled by DATA OUTPUT ENABLE from AD38. The 5 MHz line, when enabled, supplies the master clock signal which synchronizes the display to the data.

External standard

322. If an external standard is connected to the rear panel EXT STD socket, 10 MHz standard board AD4 sets the EXT STD line low to AR1 which then flags the display unit.

Line cleaner

323. The purpose of the line cleaner on this board is to remove any low frequency a.c. component in the range 5 Hz to over 200 kHz on the +5V FILT line from AR2. The circuit operates on a feedback principle. Ripple voltage at the line cleaner output is compared with a quiet reference and an error current is generated. The voltage developed by this curent across a resistor in series with the supply rail is equal and opposite to the applied ripple component. In this way the ripple voltage at the input is cancelled and the output is ripple free.

324. In order that a sufficient cancellation voltage can be developed across the series resistor R1 the correcting circuit must provide enough current drive. This means a high standing current which is provided by TR2 which sinks 30 mA. Differential amplifier IC1 controls the operation of current driver TR2, and is a high frequency op-amp which has an open loop gain of 100 at 100 kHz in order to clean up frequency components at 120 kHz generated by the switched mode power supply in the display unit. The reference for IC1 is set by the potential divider formed by R3,R5,R6. R4,C2 form a low-pass filter with very low cut-off frequency so that ripple components down to 5 Hz do not disturb the quiet ground reference on the IC1 non-inverting input. On the p.c.b. a single fixing pad is designated as the quiet ground, track to this pad is independent of circuit common ground returns. D1 speeds up settling time at switch-on by enabling C2 to quickly attain the reference level while D2 prevents reverse biasing of TR2's emitter-base junction. C7 modifies loop response and prevents spurious oscillations in the region of 2 to 5 MHz.

325. The system maintains the a.c. component on C1 at the same level as the quiet ground reference on C2. Any ripple on the +5V LC output is sensed by R1 and fed via C1 to IC1 as an error signal. This causes the inverting input of IC1 to go more positive increasing p.n.p. TR2 conduction to bleed away the extra current so restoring the original level. The output provides the line cleaned supply to 100 kHz crystal filter board AC4.

### Temperature level sensor

326. An input from the instrument sensing thermistor on board AA11 is applied via AR2 on the TEMPERATURE line to the level sensor. This consists of comparators IC2a and IC2b whose inverting inputs are connected to the potential divider consisting of the thermistor and R10,R14. References for the non-inverting inputs are supplied by potential divider R7,R11,R15. As the internal temperature rises TP2 becomes positive and the fan gets faster, controlled by the circuitry on AR2. If the temperature rises sufficiently, the voltage on IC2 pin 6 becomes more positive than the 2.4 V on pin 7, and IC2b output goes low on the HOT line to the processor on AD38. The processor then displays the OVERHEAT warning message to the user. If the temperature continues to rise until the voltage on pin 4 of IC2 exceeds the 2.8 V on pin 5, IC2a output goes low on the POWER SUPPLY CUT-OUT line to the display unit. The display unit then disconnects the power supply to the r.f. unit. A diode on AR2 prevents the voltage on the TEMPERATURE line from falling below -0.4 V in order to protect the inverting inputs of the comparators.

### Audio amplifier

327. The detected i.f. at 4 V p-p from log amp interface board AD2 is connected by this board to the rear panel VOL potentiometer. Output from the wiper of the control is fed back in to the board to amplifier IC3. This provides a gain of approximately 6 and the output is fed on the AUDIO OUT line to the rear panel PHONES jack or to the nearby loudspeaker. When, during frequency sweeps, AUDIO MUTE is asserted high from AD2, TR1 is switched on to disable the audio input to the amplifier.

### Frequency standard adjustment

328. The rear panel SET INT STD potentiometer (with combined on/off switch) is connected between +15 V supplied by AR2 and ground. When the internal standard is adjusted, potentiometer output on the INT STD ADJ line adjusts a varactor diode on AD4 which controls the 10 MHz TCXO. The switch is ganged with another which connects to ground to assert a low to the processor on the INT STD UNCAL line to AD38 to signal internal standard adjustment. When the switch is open, pull-up resistor R27 takes the line unasserted high.

## Board AR2 - Power supply interface

Circuit diagram : Chap. 7, Fig. 81

329. This board regulates then distributes the power supplied by the display unit to the various boards, in particular to the line cleaners on AB1 and those on AA11 supplying the oscillators. The board also contains the fan speed controller.

330. The -14.5 V power supply from the display unit is linked back by the interface so that the removal of the r.f. unit causes an automatic display unit power supply shutdown. This prevents an otherwise unloaded 2380 from causing overvoltage conditions at the time of reconnection to the r.f. unit.

### Voltage regulators

331. The board contains the voltage regulators for the power supplied by the display unit. There are three voltage regulators supplying +15 V from the

+20 V line, one supplying -5 V from the -8.5 V line, and two supplying -15 V from the -20 V line. Since the three regulators are similarly configured only the circuit formed around IC3 will be described. The output voltage is set by the resistor chain R6,R25,R8 with R25 enabling a small adjustment range to be provided. The V ADJ terminal of the IC is decoupled by C11 to provide the maximum ripple rejection. D5 and D6 are protection diodes to prevent external load capacitances discharging through low current paths within the IC in cases of power line failure or short circuits.

Fan speed controller

332. The instrument temperature sensing thermistor on AA11 is connected to the +14.5 V rail and forms a potential divider with R10 which is connected to the -14.5 V rail. The divider mid-point is connected to the base of TR2 as well as providing the input to the temperature sensing comparators on AR1. At $20^0$C the resistance of the thermistor is equal to that of R10 and the zero potential holds TR2 off while the current for the cooling fan is supplied from the -14.5 rail via D13. If the temperature rises, the thermistor resistance decreases so that the divider mid-point goes positive. This forward biases TR2 which starts to conduct, reverse biasing D13 and supplying an increasing current to the fan to increase its speed. The fan start voltage may be increased by linking PLV to the +5.3 V LOGIC supply (fused by FS1) instead of to earth. Diode D15 prevents the mid-point voltage from falling below -0.4 V in order to protect the inverting inputs to the comparators on AR1.

Board AZ1 - Optical encoder

Circuit diagram : Chap. 7, Fig. 47

333. This is one of two similar boards which form part of the variable REF LEVEL and MOVE controls. The board function is to indicate the direction of movement of the shaft of the control to board AF2. Power is supplied from AF2 on contacts 1 and 3 to two l.e.d's. These are optically coupled via a pierced disc mounted on the shaft to photo-detectors connected to contacts 4 and 5. By this means, as the shaft is rotated, quadrature pulses are generated for subsequent decoding on board AF2 to determine the direction and rate of movement of the control.

Board AZ2 - Sweep span switch

Circuit diagram : Chap. 7, Fig. 47

334. This board forms part of the SPAN/DIV variable control. Its function is to indicate the direction of movement of the shaft of the control to AF2. As the shaft is turned, it alternately makes and breaks with contacts 3, 4 and 5. When it makes, it applies a low from contact 1 to the connected output contact. When it breaks, a high is applied on the line by a pull-up resistor on AF2. The sequence and frequency at which the low pulses occur enable board AF2 to determine the direction and rate of movement of the control.

## TRACKING GENERATOR

335. A 5 MHz input from board AC6 is divided by 5 in AK13 and the resulting 1 MHz is compared for phase with the 502.6 MHz v.c.o. on AK12 in order to lock it to the frequency standard (Fig. 16). VCO output is divided by 502.6 in AK13 to produce the 1 MHz required for the phase comparison. Oscillator output is fed via input amplifier AK12, controlled by the a.g.c. line from AK11, to mixer board AK8. To supply the mixer drive the input from the second local oscillator at 4.4 GHz from AH11 is applied via combline filter AK10 and amplifier AK9. 4.9 GHz band-pass filter AK7 selects the sum frequency of 4.9026 GHz for passing to the mixer on AK5. Power splitter AJ3 applies the input from the first local oscillator via amplifier AK6 to provide the 0 to 4.9026 GHz drive to the mixer. The difference frequency of 0 to 4.2 GHz is selected by the following low-pass filter and fed to the amplifier on AK4. Amplifier gain is controlled by AK14 which also controls the gain of the AK6 and AK9 amplifiers. A further function of AK14 is to control the operation of the following switch boards AK3 and AK2. These determine whether the input is to provide the tracking generator or the calibrating signal. Board AK3 switches the input to either the front panel TRACKING GENERATOR socket or on to calibrator switch board AK2. There are two switch boards AK2 in order to provide maximum isolation from the tracking generator signal when the calibrating output is not selected. When, during the calibration process, the tracking calibrator output is selected, AK1 sends the signal to input switch board AG1. The appropriate levelling detector, on AK3 for the tracking generator and on AK1 for the calibrator, is selected by AK11 to control the level of the a.g.c. signal to the input amplifier on AK12. This enables the calibrating output to be maintained at -10 dBm and the tracking generator output to be set between -10 and -20 dBm over its entire frequency range.

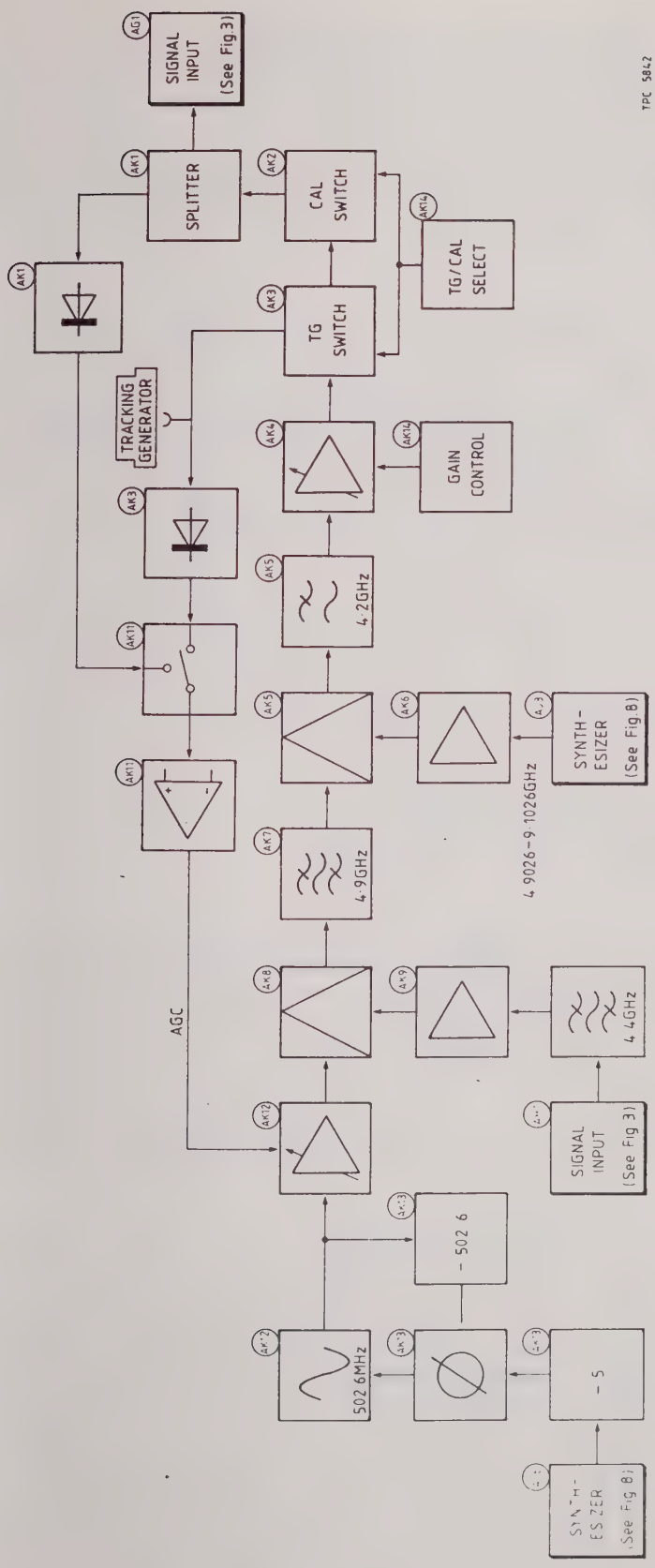


Fig. 16 Tracking generator block diagram showing main functions of boards.

## Board AK1 - Calibrator levelling detector

Circuit diagram : Chap. 7, Fig. 65

336. AK1 provides the detection for the tracking calibrator system. The tracking generator output from AK2(2) is detected and the video signal drives the levelling comparator on AK11. The levelled output is routed to the input switch assembly and provides a precision frequency response reference for instrument calibration.

337. During response calibration the isolator switches on AK2(1) and AK2(2) route the tracking generator signal, in the range 0 to 4.2 GHz, to the 2-resistor splitter. The output arm is connected to input switch AG1 where, when selected during calibration, it provides a calibrated input for the signal path. And to ensure that this signal is at the correct level, the second arm is connected via a 6 dB pad to a levelling detector. The detector ensures that the signal level at the junction of the splitter is held constant by the action of the levelling loop. The output arm of the splitter thus acts as a constant voltage source in series with 50 ohms. The 6dB pad in the detector arm improves the v.s.w.r. of the detector. Beam lead detector diodes D1 and D2 monitor the r.f. signal across a 50 ohm load. The diodes are connected in antiphase to improve overall sensitivity and 2nd harmonic rejection. C1 and C2 act as r.f. bypasses over most of the operating band, while C4 and C5 extend the response below 400 kHz. Output from the positive and negative detectors on the DETECTOR OUTPUT lines is fed to the levelling loop on AK11.

## Board AK2 - Calibrator isolation switch

Circuit diagram : Chap. 7, Fig. 66

338. There are two boards AK2 in the instrument. When required, AK2(2) switches the 0 to 4.2 GHz input from AK3 to AK2(1) which in turn switches it to calibrator levelling detector board AK1. Switching is performed by pin diodes D1 to D3 under the control of board AK14. When in calibration mode, the signal is switched through from AK3 to AK1 by the CAL(L) and TG(L) lines from AK14 being taken low and high respectively, which switches on D1 and switches off D2 and D3. When calibration is not taking place the logic levels, and therefore the switch operations, are reversed thereby isolating the calibrator from the tracking generator output.

## Board AK3 - TG switch and detector

Circuit diagram : Chap. 7, Fig. 67

339. The input from amplifier AK4 in the range 0 to 4.2 GHz is fed into board AK3 where it takes one of two switch-selected paths. One path is to AK2 to supply the tracking calibrator signal, while the other supplies the tracking generator output signal. Switching is performed by pin diodes D1 to D4 under the control of AK14. When in calibration mode the signal is switched through from AK4 to AK2 by the CAL(L) and TG(L) lines from AK14 being taken low and high respectively, which switches on D2,D4 and switches off D1,D3. When calibration is not taking place the logic levels, and therefore the switch operations, are reversed and the tracking generator output is

selected. This takes two paths. One path is to the front panel TRACKING GENERATOR output socket. And to ensure that this signal is at the correct level, the second path is fed via a 6 dB pad to a levelling detector formed from zero bias Schottky diodes. Output from the positive and negative detectors is fed on the TG DET +VE and TG DET -VE lines to the levelling loop on AK11 and used to maintain the tracking generator output level at a constant -10 dBm.

**Board AK4 - TG output amplifier**

Circuit diagram : Chap. 7, Fig. 68

340. This board is a thin film circuit fabricated on alumina and contains a number of printed microstrip elements. Input to the board is at 0 to 4.2 GHz from the mixer on AK5. The board contains four single-stage GaAs f.e.t. amplifiers TR1 to TR4 which together provide 25 dB of gain. Bias for the amplifiers is supplied by AK14 which operates on the principle of varying the gate voltage to achieve a desired drain current. Output is fed to AK3.

**Board AK5 - TG output mixer and l.p. filter**

Circuit diagram : Chap. 7, Fig. 69

341. To give the 0 to 4.2 GHz ouput signal, the 4.9026 GHz input signal from AK7 is mixed with the 4.9026 to 9.1026 GHz local oscillator drive from board AK6. The mixer is a single balanced Marchand balun design utilising a pair of high barrier Schottky diodes in a 'T' package. The balun is of triplate construction and has additional duroid slices in the top cover and in the block beneath the substrate.

342. The following 4.2 GHz low-pass filter is made entirely of printed microstrip components. Input and output matching is achieved with suspended stripline stubs necessitating a milled channel in the block beneath the substrate. A centre stub is used to provide a notch at 4.9026 GHz (the i.f.). The signal is fed to the output amplifier on board AK4.

**Board AK6 - 1st l.o. amplifier**

Circuit diagram : Chap. 7, Fig. 77

343. AK6 is one of 3 identical boards; the others are AH6 and AJ2. They are all identified as AL1 in Chap. 6, Replaceable Parts and Chap. 7, Servicing Diagrams. The board takes the 4.9026 to 9.1026 GHz ouput from the YTO, amplifies it by 9 dBm, and passes it out via a 3 dB pad to the mixer on board AK5. TR1, TR2 and TR3 are GaAs f.e.t.s whose bias is supplied from AK14 which operates on the principle of varying the gate voltage to achieve a desired gain current. AK14 also provides protection for the f.e.t.s.

## Board AK7 - 4.9 GHz coupled-line filter

Circuit diagram : Chap.7, Fig. 70

344. This board contains the 4.9 GHz coupled-line filter which is formed entirely from microstrip transmission lines. It selects the sum of the inputs to the preceding mixer on board AK8. The resulting 4.9026 GHz signal is fed via a 3 dB pad to the output mixer on board AK5.

## Board AK8 - TG 2nd mixer

Circuit diagram : Chap. 7, Fig. 71

345. Local oscillator drive at 4.4 GHz from AK9 up-converts the incoming signal at 502.6 MHz from AK12 to a frequency of 4.9026 GHz. The mixer utilises a pair of high barrier X-band Schottky diodes in a single balanced rat-race configuration. The input line has two open-circuit stubs. One at 4.4 GHz and one at 8.8 GHz enhance performance and reduce l.o. leakage levels. There are also two short-circuit stubs in the output line to suppress spurious signals at 4.4, 8.8 and 9.3 GHz. There is also one short-circuit stub on the l.o. drive line tuned to 4.4 GHz to give a short-circuit termination at 502.6 GHz. The ring is tuned to 4.7 GHz, the mean of the i.f. and l.o. frequencies. Output is to filter board AK7.

## Board AK9 - 2nd l.o. amplifier & Unit AK0 (Part) - Combline filter

Circuit diagram : Chap. 7, Fig. 78

346. AK9 is one of 3 identical boards; the others are AH7 and AH10. They are all identified as AL2 in Chap. 6, Replaceable Parts and Chap. 7, Servicing diagrams. The input from power splitter AH11 enters the AK block via the combline filter which forms part of unit AK0 and is a band-pass filter centred on 4.4 GHz. Filter output is fed to board AK9 containing GaAs f.e.t. amplifier TR1 which provides an overall gain of 9 dB. Bias for TR1 is supplied from AK14 which operates on the principle of varying the gate voltage to achieve a desired gain current. AK14 also provides protection for the f.e.t. The output provides the local oscillator signal for the up-converting mixer on AK8. The notch filter on the output suppresses unwanted signals at 3.3 and 5.5 GHz.

## Board AK11 - 502.6 MHz levelling loop

Circuit diagram : Chap.7, Fig. 72

347. Board AK11, in conjunction with AK12, performs the 502.6 MHz i.f. levelling function which maintains the tracking generator output level constant over its full frequency range. In the calibrating mode, calibrator detector AK1 output is selected and compared with a predetermined d.c. reference level. Comparator output voltage then determines the gain of the gain controlled amplifier on AK12 so that the calibrating signal level is set to -10 dBm. In tracking generator mode, tracking generator detector AK3 output is selected instead and the gain controlled amplifier on AK12 is adjusted to enable the tracking generator signal level to be set within the range -20 to -10 dBm.

Input selection

348. The +ve and -ve inputs from the TG DET lines from AK3 and the CAL DET lines from AK1 are applied to buffer amplifiers IC1 and IC2 respectively. These convert the balanced detector voltages into single sided voltages. Each amplifier is a low-noise, low offset IC wired as a differential amplifier with a gain of 56. Presets R10 and R20 enable the offsets to be zeroed. Both outputs feed to the selector circuit which consists of c.m.o.s. switches IC4a and IC4b controlled by discrete inverter drivers TR5 and TR6. In the tracking mode, the TG/CAL line is taken high by AB1 which switches TR5 and TR6 on causing IC4a to switch on to connect IC1 output to comparator IC5b. In the calibrator mode, the low logic level turns both TR5 and TR6 off switching IC4b on and connecting IC2 to the output comparator. Voltage follower IC5a buffers the output comparator from the high on resistance of the c.m.o.s. switches.

Anti-log shaper

349. The anti-log shaper converts the 0 to 10 V input on the TG LEVEL line from AB1 into an output reference d.c. level in the range 100 mV to 2.0 V, which corresponds to a 26 dB voltage range at comparator IC5b input. The conversion law is closely antilogarithmic, and because of the square-law characteristics of the signal detectors, the TG LEVEL range of 0 to 10 V corresponds to a signal level range of 13 dB. Thus the TG LEVEL sensitivity is 1.3 dB per volt.

350. Amplifier IC6a together with switches TR1 to TR4 form a 3 dB piecewise logarithmic shaper. IC6a is an inverting stage whose gain is determined by the parallel combination of R61 and those resistors R62 to R65 switched in by TR1 to TR4. The circuit gain is linear between the break-points at which the transistors switch state. Break-points are determined by the transistor base bias chain and are as follows :-

TR1b = -2.2 V TR2b = -3.4 V TR3b = -4.9 V TR4b = -6.4 V.

The circuit gain decreases from 10 when input is less than 0.25 V and all transistors are off, to 0.75 when input is greater than 2.0 V and all transistors are on.

351. The logarithmic shaper performs the following nominal translation :-

| Relative signal level (dB) | 0 | 1 | 4 | 7 | 10 | 13 |
|---|---|---|---|---|---|---|
| Stage input (V) | 0.20 | 0.25 | 0.5 | 1.0 | 2.0 | 4.0 |
| Stage output (V) | -2.0 | -2.5 | -4.0 | -5.5 | -7.0 | -8.5 |

352. IC6b is an inverting stage having a gain of 1.54, and with offset adjustable by R50. This amplifier linearly translates the -2.0 to -8.5 V input from the first stage of the shaper into a 0 to 10 V output range. IC7a and IC7b provide stabilised voltage sypplies of -10 V for the transistor bias chain and +6 V for IC6b offset. These supplies are derived from reference Zener diode D2 and so have high temperature stability and are independent of the +/- 15 V supply variations. R40 presets the law of the logarithmic shaper stage by adjusting the voltage on the transistor base bias chain. D1 provides compensation for transistor Vbe variations with temperature.

353. IC6c is a comparator with the logarithmic shaper circuit connected as negative feedback; the composite circuit behaves as an antilogarithmic shaper with the input TG LEVEL of 0 to 10 V translating into an output of 0.2 to 4.0 V. This output is halved by resistors R70 and R71 and buffered by voltage follower IC6d to give the required reference d.c. level of 100 mV to 2.0 V for the output comparator.

Output comparator

354. Comparator IC5b is a differential amplifier with a gain of 390. Its non-inverting input is connected to the amplified detector output from IC5a, and its inverting input is connected to the reference d.c. level from IC6d. The resulting output voltage on the V GAIN line is used to adjust the gain controlled amplifier on board AK12. C30 and R35 control the levelling loop dynamic response by limiting the loop bandwidth to 3 kHz. R30 presets the offset so that the output on the V GAIN line is -2.5 V when both inputs to the comparator are equal. This optimises comparator offset errors when V GAIN is within its normal operating range, thereby minimising deviation from anti-log law.

## Board AK12 - 502.6 MHz v.c.o.

Circuit diagram : Chap. 7, Fig. 73

Oscillator

355. Voltage controlled oscillator TR1 is a common-collector Clapp oscillator operating at 502.6 MHz. The tuned circuit consists of L3,C8,C10 and varactor diode D1. Oscillator frequency is preset to 502.6 MHz by inductor L3 which is completed by an adjustable link wired between two parallel strips of printed track. The control voltage on the V TUNE line from the phase detector on AK13 is fed to varactor diode D1. Output from the emitter of sustaining amplifier TR1 is buffered from the following power splitter by grounded emitter amplifier TR2. Power splitter T1,T2 has a 3 dB power loss between the input and each of the two outputs.

Isolating amplifier

356. One output from the power splitter is to the isolating amplifier formed by TR20 and TR21. This two stage amplifier has a reverse isolation of 60 dB and prevents unwanted frequency products from the phase locking circuitry from appearing on the 502.6 MHz i.f. output. Forward gain is 10 dB which, in conjunction with the 10 dB pad at the input, results in unity gain between the power splitter output and the board output to AK13. This provides a constant level as part of the phase locked loop.

Gain controlled amplifier

357. A second output from the power splitter is to the two stage gain controlled amplifier formed by TR40 and TR41 each in common emitter configuration. Gain is controlled by the voltage on the V GAIN line from the levelling loop on AK11. This is connected to pin diodes D40 and D41 which have an effective r.f. resistance which decreases with increasing d.c. bias current. By this means each stage has 13 dB of level control. When the voltage on the V GAIN line is 0 V the pin diode current is zero and each stage has maximum emitter resistance. Amplifier gain is then minimum, being mainly

determined by emitter resistors R47 and R54 and stray capacitance. When the voltage is -12 V the pin diode current is 2 mA and each stage has minimum emitter resistance. Amplifier gain is then maximum. L40 and C56 at the amplifier input suppress spurious high frequency oscillation.

358. The preceding 6 dB pad adjusts the input signal level to -4 dBm so that the amplifier operates over its optimum range to give an output level between -19 and +7 dBm as V GAIN is varied between 0 and -12 V. Output is via TR42, a single transistor buffer stage, which drives the mixer on board AK8.

## Board AK13 - 502.6 MHz phase detector

Circuit diagram : Chap. 7, Fig. 74

359. Phase detector board AK13 forms a phase locked loop with the voltage controlled oscillator on AK12, thereby locking the 502.6 MHz i.f. to the instrument 5 MHz reference.

### Isolating amplifier

360. From the v.c.o. on AK12 the 502.6 MHz signal enters at PLA and is passed through a 6 dB pad to TR1. This is an isolating amplifier which provides 5 dB of gain with 30 dB reverse isolation. Signal level at the amplifier output is the same as at the PLA input. Overall reverse isolation is 35 dB keeping the 502.6 MHz i.f. free from unwanted phase locking frequency products.

### Prescaler

361. Prescaler IC1 is a u.h.f. divider operating at e.c.l. levels. It is a dual modulus prescaler which divides by 10 when its M1 input is logically high and divides by 11 when M1 is low. The complementary outputs are converted to t.t.l. levels by fast switching long-tailed pair TR2 and TR3. The resulting TTL CLK signal is used to clock the fractional divider.

### Fractional divider

362. The purpose of the fractional divider is to enable the 502.6 MHz input to the prescaler to be divided by 502.6 to produce a 1 MHz output. The fractional divider consists of the main and reset counters which together divide by 50, the division programmer, and the modulus controller controlling division by either 10 or 11. During each cycle of the resulting 50 TTL CLK periods, the modulus controller programmes the prescaler to divide by 11 for either 2 or 3 TTL CLK periods. Thus each cycle represents a division of the input frequency by either 502 or 503 as follows :-

$$(48 \times 10) + (2 \times 11) = 502 \quad \text{-or-} \quad (47 \times 10) + (3 \times 11) = 503$$

363. The main counter consists of IC3 and IC4. IC3 is a 50 MHz positive-edge triggered binary counter, while IC4 is a negative-edge triggered binary counter clocked by the terminal count of IC3. The main counter is loaded with D5 (hex), IC3 counts down and IC4 counts up until after 46 TTL CLK pulses NOR-gate IC5a decodes the counter state of 07 (hex).

364. Reset counter IC6 continues the count during the relatively slow reset period of the main counter. It is a 50 MHz positive-edge triggered dual bistable which counts to 4 when enabled by IC5a output going high. Thus

together the main and reset counters divide the TTL CLK signal by 50. At the conclusion of the reset count the main counter is re-enabled. Outputs from the bistables are taken to NOR-gates IC5b and IC5c which together code an N = 2 or N = 3 pulse at TP2 according to whether TP3 is high or low. The length of this pulse determines whether the prescaler divides by 11 for 2 or 3 periods.

365. Division programmer IC7a is a divide by 5 counter which produces a low,high,low,high,low sequence at TP3 in each 5 cycle period. Thus the input is divided successively by 503,502,503,502,503 so that over a 5 cycle period the mean division ratio is 502.6 as required.

366. Modulus controller IC2a is configured as a D-type bistable and synchronises the signal at TP2 to the TTL CLK signal. This ensures correct timing of the output supplying the M1 input to prescaler IC1. Resistor chain R17,R18,R19 converts the signal from t.t.l. to the necessary e.c.l. levels.

Phase detector

367. The phase detector consists of two bistables, IC9a triggered by the 1 MHz reference, and IC2b triggered by the fractional divider output. IC7b divides the 5 MHz input from AC6 to provide the 1 MHz reference. Both bistables' Q outputs are connected via NOR-gate IC5d to IC9b which effectively provides a reset signal. IC9b is wired as an inverter to the signal from the NOR-gate so that it resets the bistables only when both have been triggered. The resulting pulses are used to drive the following current switch. The difference between the pulse widths of the two signals is a measure of the phase difference between the 502.6 MHz input from AK12 and the 1 MHz reference. Only when the v.c.o. is exactly locked to the reference are the pulses of equal duration.

Current switch

368. The current switch converts the phase detector pulses into either a current source or a current sink. The switch consists of two long-tailed pairs TR5,TR6 and TR9,TR10 driven by TR4 and TR8. Normally, i.e. in the absence of a pulse from the phase detector, TR4 and TR8 are both on causing TR5 and TR9 to be on and biasing TR6 and TR10 both off. In this condition no current flows into the following loop filter.

369. When detector IC9a is triggered TR4 is turned off, turning TR5 off and TR6 on. TR6 is biased as a 20 mA current source and the loop filter integrates this current so that V TUNE increases linearly. When IC2b is triggered TR8 is turned off, turning TR9 off and TR10 on. TR10 is biased as a current sink so that current is drawn from the integrating loop filter and V TUNE decreases linearly. For the duration of the phase detector reset, when both IC9a and IC2b have been triggered, TR6 source current flows into TR10 sink. Thus net current flows into or out of the loop filter only when there is a phase error. C20 and C30 speed up the switching transitions.

Output

370. Loop filter C43,R46,C44 integrates the current from the current switch and determines the loop bandwidth of 20 kHz. IC10b which follows buffers the resulting v.c.o. tuning voltage on the V TUNE line to AK12.

### Sideband suppression

371. The sideband suppression circuit formed by IC10a, TR7 and NOR-gates IC8 minimises the 200 kHz sideband component caused by fractional division. Because division by 502.6 is accomplished by successive divisions by 502 and 503, each divider output pulse has a small phase error with respect to the 1 MHz reference. While this error averages to zero over a 5 cycle period, it results in a small 200 kHz modulating waveform at the loop filter. To cancel this, an equal and opposite wave form is applied to the earthy side of the filter.

372. Open collector NOR-gates of IC8 in conjunction with R43 and R44 form a switched current source. This uses the outputs from division programmer IC7a to generate the correctly phased cancellation waveform across R45 and R50. C41 and C42 determine the waveform time constant. TR7 and IC10a, connected to the current switch, ensure that the switched current source is directly related to the 20 mA source, so optimising cancellation.

## Board AK14 - TG supply distribution

Circuit diagram : Chap. 7, Figs. 75 & 76

373. Board AK14 supplies power, bias and control information to the circuits on the tracking generator (AK) block as follows :-

(1) Bias for the GaAs f.e.t. amplifiers on AK6 and AK9.

(2) Bias for the GaAs f.e.t. output amplifier on AK4.

(3) Supply switching for the 502.6 MHz generating circuits.

(4) Steering for the pin diode switches which switch between calibratiing and tracking generator outputs.

### Supply switch

374. The t.t.l. instruction on the TG ON/OFF line from AB1 is fed to TR1 which has pull-up resistor R1 on its input to ensure that it is turned on when the line is taken high. When TR1 is on, most of its collector current flows through TR61 base, turning it on. TR61 saturates so that its collector voltage, which supplies the positive rail of AK11, is within a small fraction of a volt of the +15 V rail. TR61 collector current supplies 190 mA to AK11 and the rest to AK14. TR2 also switches on, which turns TR3 on so that its collector supplies the 100 mA required for AK11's negative rail. Again, this transistor saturates so that the negative supply is within a fraction of a volt of the -15 V rail.

### FET bias supply and protection

375. There are eight similar bias regulator stages on this board; four supplying AK6 and AK9 and fed from the voltage reference, and four supplying AK4 and fed from TR61 collector. The voltage reference is a resistor chain formed by R26 to R28 which provides 10.1 V (drain supply reference) and 8.2 V (drain voltage reference) supplied from the +15 V rail. The bias circuits are designed to fulfil the following aims :-

flows into TR11 base. The collector voltage of TR7 rises until it saturates at 10.7 V. Under these conditions, TR11 provides a low source resistance 10 V supply which feeds current out via resistors R20, R21 and R22. These currents flow through the pin diode switches on AK2 and AK3 which select the calibrator output as required. Diodes D1 and D2 protect the emitter-base junctions of TR9 and TR11 from reverse breakdown by limiting the reverse voltage to 0.7 V.

379. When the input logic level is taken high, TR4 and TR8 are both off and TR5 and TR10 are both on, switching the -20 V supply to R20, R21 and R22, while TR9 provides the +10 V supply to R23, R24 and R25. In these conditions the output to the TRACKING GENERATOR is selected.

# Chapter 5-0

## MAINTENANCE

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## INTRODUCTION

1. This chapter provides servicing support information for the three chapters which follow:

5-1: PERFORMANCE TESTING - procedures for verifying that the equipment complies with the Performance Data in Chap. 1.

5-2: ADJUSTMENT AND CALIBRATION - tests and adjustments for restoring the equipment to peak performance.

5-3: FAULT DIAGNOSIS - procedures for localizing faults to at least sub-assembly level (normally a printed circuit board), together with information on repair and replacement.

2. In case of difficulties which cannot be resolved with the aid of this manual, please contact our Service Division at the address at the rear of the manual or your nearest Marconi Instruments representative. Always quote the type number and serial number found on the instrument data plate.

## SAFETY PRECAUTIONS

3. Although this equipment has been designed and constructed in accordance with international safety standards, it is important that the advice given under NOTES AND CAUTIONS at the front of this manual should be observed in all

maintenance procedures to ensure safe working practices. In addition to these general precautions, special handling techniques are required for certain items, as below.

Chip components

4. Numerous chip capacitors and resistors are fitted in this instrument. These have silver palladium end cap terminations. When soldering these devices the following precautions should be observed.

(i) Use solder containing 3% silver, and a temperature controlled 45 W soldering iron set to 315°C (600°F). The use of a high wattage soldering iron will minimize the time taken to solder the device.

(ii) When soldering chip components to printed circuit boards a long fillet of solder should be laid on the track leading up to each end cap termination. This reduces the otherwise adverse inductive effects at high frequencies.

5. Static sensitive components. The c.m.o.s. integrated circuits used in this instrument have extremely high input resistance and can be damaged by accumulation of static charges (see preliminary pages, Notes and Cautions). Boards that have such integrated circuits all carry warning notices against damage by static discharge. Take care also when using freezer sprays to aid fault finding. These can create a static charge likely to change the programmed memory of (E)PROMS.

6. Bulkhead connectors and gaskets. To ensure that no r.f. leakage occurs all bulkhead connectors and lid sealing gaskets must be securely fitted. It is essential that the unit lids are correctly relocated in their slotted recesses after removal and all the screw type connectors are tightened up to their specified torque.

7. Transistor and diode checking. Transistors may be checked by measuring the electrode voltages and/or by measuring the resistance between electrodes by means of a multimeter. So that the meter voltage does not damage the transistors or diodes use the lowest voltage and the maximum source resistance available, e.g. the Ω range on the AVO 8 or the SEI Selectest Super 50.

RECOMMENDED TEST EQUIPMENT

8. The test equipment recommended for use in Chaps. 5-1, 5-2 and 5-3 is shown in Table 1. Alternative equipment may be used provided it complies with the stated minimum specification.

TABLE 1 RECOMMENDED TEST EQUIPMENT

| Description | Minimum specification | Example | Use[1] |
|---|---|---|---|
| Synthesized Generators | Frequency range: 5 Hz to 1 MHz<br>Output range: -40 dBm to +10 dBm | Hewlett-Packard 3325A | PF |
| | Frequency range: 1 MHz to 1 GHz<br>Output range: -40 dBm to +10 dBm | Marconi 2019A | PAF |
| | Frequency range: 1 GHz to 4.2 GHz<br>Output range: -40 dBm to +10 dBm | Wiltron 6700A | PF |
| Sweep Generator | Frequency range: 10 MHz to 4.2 GHz<br>Output range: 5 dBm | Marconi 6311 | P |
| Oscillator (2 off) | Centre frequency: 100 MHz<br>Output level: 0 dBm<br>Phase noise: <-90 dBc/Hz at 1 kHz<br>Short term stability: 1 part in $10^9$ | HCD Research 185R | P |
| Variable d.c. power supply | Range: 0 V to + 12 V d.c. | Marconi 2158 | AF |
| RF amplifiers | Frequency range: 1 MHz to 1 GHz<br>Gain: 40 dB | Marconi 2177 | PA |
| | Frequency range: 1 GHz to 4.2 GHz<br>Gain: 30 dB | Mini-Circuits ZHL-42 | PA |
| Power meter | Frequency range: d.c. to 50 MHz<br>Accuracy: ±0.01 dB | Wandel & Goltermann EPM1 | PF |
| Power meter (high frequency) | Frequency range: 30 kHz to 4.2 GHz<br>Accuracy: ±0.02 dB | Marconi 6960 & 6912 sensor | PA |
| Counter | Frequency range: 10 Hz to 12 GHz | Marconi 2440 | PAF |
| Digital multimeter | Functions: d.c. volts, resistance | Solartron 7150 | AF |
| Oscilloscope | Frequency range: d.c. to 100 MHz | Tektronix 2235 | PAF |

[1] P = Performance testing A = Adjustment and calibration F = Fault location

TABLE 1 RECOMMENDED TEST EQUIPMENT (continued)

| Description | Minimum specification | Example | Use |
|---|---|---|---|
| Spectrum analyzers | Frequency range: 100 Hz to 4.2 GHz (with tracking generator facility) | Marconi 2383 | PAF |
| | Frequency range: 1 GHz to 12 GHz | Anritsu MS 710C | PAF |
| Amplitude analyzer | Frequency range: 10 MHz to 4.2 GHz with adaptor lead for D.C. input. | Marconi 6500 | P |
| Active probe | Frequency range: 100 kHz to 1 GHz | Marconi 2388 | AF |
| Step attenuator | 60 dB in 10 dB steps | Hewlett-Packard 8495A | PF |
| Attenuator pads | 3, 10, 20, 20, 30 dB BNC connectors (with correction figures at 50 MHz) | Texscan FP-50 series | P |
| Power splitter | Frequency range: d.c. to 4.2 GHz<br>Impedance: 50 Ω | Weinschel 1870A | P |
| Combiner | Frequency: 100 MHz<br>Impedance: 50 Ω | Mini-Circuits ZFSC-2-1 | P |
| Low-pass filter | Cut-off frequency: 100 MHz<br>Attenuation at 200 MHz: >50 dB | Telonic TLA100-4FE1 | P |
| VSWR bridge | Frequency range: 10 MHz to 4.2 GHz<br>Negative detector output | Wiltron 63N50-2 | PAF |
| Termination (qty. 2) | Impedance: 50 Ω<br>Type N connector | Weinschel 1404 | P |
| Mismatch | 0.5 Ω in series between type N connectors | - | P |
| Coaxial adapters | Type SMA male to N female, 50 Ω<br>Type SMA female to N male, 50 Ω<br>Signal injector assembly | Radiall R191327 A<br>Radiall R191329 A<br>Marconi 44990-810 A | |

TABLE 1 RECOMMENDED TEST EQUIPMENT (continued)

| | | | |
|---|---|---|---|
| Coaxial lead | 1.0 m long type N connectors<br>Impedance: 50 Ω | RG214 | P |
| | 1.0 m long type BNC connectors | Marconi 43126-012 | P |
| Semi-rigid | 0.75 m long type N connectors | Suhner | P |

## ACCESS TO TRAYS AND BOARDS

### Removal of outer covers

9. To remove the top and bottom outer covers, unscrew the two retaining screws situated on the rear panel, slide each cover slightly to the rear, then lift off.

### Access to trays

10. Within the instrument there are three trays. From top to bottom these are:-

Third IF unit, uP unit - AC0, AD0
Second IF unit, HF & UHF Synth unit - AA0, AB0
Receiver unit, TG unit, YIG unit - AH0, AK0, AJ0

Of these, the centre tray is fixed in position while the top and bottom trays are both hinged at the rear and may be opened out. This is only necessary for access to AA0, AB0, AC0 or to the front panel boards AF1 and AF2. The trays, opened out in the optional servicing position, together with their boards, are shown in Fig. 1.

11. To open out the trays proceed as follows:-

AC0/AD0 tray

(1) Remove the four large cross-head screws, two from each side of the AC0/AD0 tray.

(2) Carefully open out the tray. The tray may be locked at a right angle by inserting the previously removed screws in the holes provided next to the rear hinges.

Microwave tray

(3) Remove the M3 cross-head screw and plain washer from the front and rear, and the two M4 slotted screws and washers from each side, carefully slide the tray rearward in its slots and then disconnect the following semi-rigid pipe connections:-

(i) SMA on AK3 to front panel Tracking Generator output.

(ii) SMC on AE1 to front panel 50 MHz STD output.

(iii) SMC on AE1 to AG1 (Input switch)

(iv) SMA on AG1 to AK1 (Calibrator output)
(use special tool 34901-087)

(v) SMA on AG1 to AG3 (Power pick-off)
(use special tool 34901-087)

(vi) SMA on AH5 to AA2 (2nd IF output)

(4) Carefully raise the tray ensuring that no undue strain is placed on any of the semi-rigid coax pipes.

(5) When replacing the semi-rigid pipe connections it is imperative that the following torque settings are used:-

SMA : 99 - 106 N-cm

SMC : 42 - 49 N-cm

Caution: Since the microwave blocks are milled from the solid and are therefore inherently heavy, the tray must be well supported when opened out for servicing.

## Access to boards

12. Most boards are protected and screened by metal lids. For access to these boards, lift off the lids after removing all retaining screws. When replacing a lid, ensure that the gasket is correctly fitted. The positions of the boards within their trays are shown in Fig. 1.

13. For identification of individual components on a board see the board layout diagrams opposite the circuit diagrams in Chap. 7.

## Removal of boards

14. The boards may be removed from within the tray after unscrewing the retaining male-female hexagonal pillars and cross-head screws. Take care to disconnect all flying leads, ribbon connectors and board-to-board couplers. Board couplers are removed by gently pressing down on either side, to disengage the retaining slot from the tray wall, and then moved sideways.

| | | |
|---|---|---|
| RF TRAY | AA2 | 44829-544A |
| | 3 | 44990-441H |
| | 3a | 44828-452L |
| | 4 | 44828-526V |
| | 4a | 44829-141T |
| | 5 | 44828-527S |
| | 6 | 44828-528W |
| | 7 | 44829-529D |
| | 8 | 44828-530S |
| | 9/1 | 44828-458W |
| | 10/1 | 44829-493A |
| RF TRAY | AB1 | 44828-547E |
| | 2 | 44828-537C |
| | 3 | 44828-464P |
| | 4 | 44828-465X |
| | 5 | 44828-466M |
| | 6 | 44828-467C |
| | 7 | 44828-538R |
| | 8 | 44828-543K |

| | | |
|---|---|---|
| IF TRAY | AC1 | 44828-540B |
| | 2 | 44828-473K |
| | 3 | 44828-474A |
| | 4 | 44828-475Z |
| | 5 | 44828-476X |
| | 6 | 44828-477E |
| IF TRAY | AD1 | 44829-479Y |
| | 2 | 44829-140D |
| | 3 | 44828-535X |
| | 4 | 44829-139P |

| | | |
|---|---|---|
| MICROWAVE TRAYS | AE1 | 44990-665P |
| | AG1 | 44338-120H |
| | 2 | 44429-031Y |
| | 3 | 44990-672R |
| | AH0 | 44990-666X |
| | AJ0 | 44990-667M |
| | AK0 | 44990-668C |
| FRONT & REAR PANELS | AF1 | 44828-494D |
| | 2 | 44828-493T |
| | AR1 | 44828-496P |
| | 2 | 44828-541R |
| | AZ1 | 44828-523J |
| | 2 | 44828-498M |

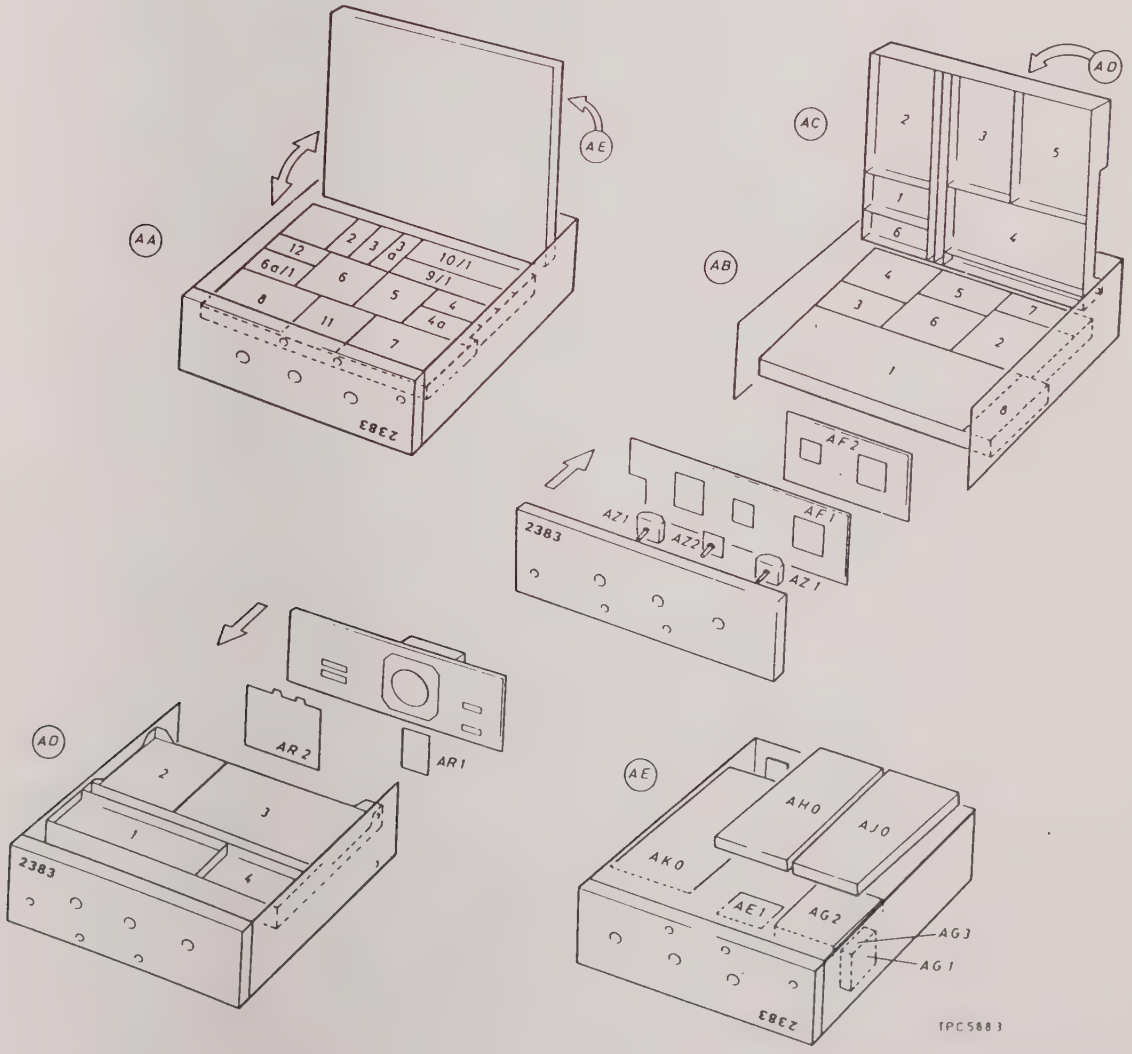


Fig. 1 Location of trays and boards, with the top and bottom trays shown opened out in the optional position.

## Removal of front panel

15. The front panel assembly may be removed as a unit as follows:-

(1) Stand the instrument on its rear feet and hinge down the microwave tray (see 'Access to trays').

(2) Remove the front handle trim strips after removing the two cross-headed screws. This will reveal two screws for each handle. Remove the screws and handles.

(3) Disconnect the ribbon cable from above the marker move encoder. Disconnect the two remaining cables.

(4) Release the front panel by removing the hexagonal nut (clamping the attenuator to the rear of the panel) adjacent to the probe socket.

| | | |
|---|---|---|
| Second IF Unit | AA2 | 44828-544A |
| | 3a | 44828-452L |
| UHF Synth | AA4 | 44828-526V |
| | 4a | 44828-141T |
| | 5 | 44828-527S |
| | 6a/1 | 44990-809K |
| | 7 | 44829-529D |
| | 8 | 44828-530S |
| | 9/1 | 44828-456H |
| | 10/1 | 44829-493A |
| | 11 | 44828-533T |
| | 12 | 44828-534 |
| HF Synth | AB1 | 44828-547E |
| | 1/1 | 44829-507J |
| | 2 | 44828-537C |
| | 3 | 44828-464P |
| | 4 | 44828-465X |
| | 5 | 44828-466M |
| | 6 | 44828-467C |
| | 7 | 44828-538R |
| | 8 | 44828-543K |
| Third IF Unit | AC1 | 44828-540C |
| | 2 | 44828-473K |
| | 3 | 44828-474A |
| | 4 | 44828-475Z |
| | 5 | 44828-476X |
| | 6 | 44828-477E |
| uP Unit | AD1 | 44828-479Y |
| | 2 | 44829-140D |
| | 38 | 44828-535X |
| | 4 | 44829-139P |
| Microwave Tray | AE1 | 44828-548U |
| | AG1 | 44338-120H |
| | 2 | 44429-031Y |
| | 3 | 44990-672R |
| | AH0 | 44990-666X |
| | AJ0 | 44990-667M |
| | AK0 | 44990-668C |
| FRONT & REAR PANELS | AF1 | 44828-494D |
| | 2 | 44828-495T |
| | AR1 | 44829-451P |
| | 2 | 44828-541R |
| | AZ1 | 44828-523J |
| | 2 | 44828-498M |

# Chapter 5-1

## PERFORMANCE TESTING

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## INTRODUCTION

1. The test procedures in this chapter enable the user to verify that the electrical performance of the Spectrum Analyzer, together with its Display Unit, complies with the Performance Data given in Chap. 1 of the Operating Manual Vol. 1. The test equipment recommended for this purpose is listed in Chap 5-0 of this manual. All tests may be performed with the covers in place and are intended to be carried out in the order given. For convenience the test equipment and specification for each test are summarized before the test procedure.

## TEST PRECAUTIONS

2. To ensure minimum errors and uncertainties when making measurements, it is important to observe the following precautions:-

(1) Always use recently calibrated test equipment, with any correction figures taken into account, so as to establish a known or traceable limit of performance uncertainty. This uncertainty must be allowed for in determining the accuracy of measurements.

(2) A common external frequency standard, with an accuracy within ±1 part in $10^6$, should be used for the analyzer and for the test generator and other frequency controlled test equipment.

(3) Use the shortest possible connecting leads; ideally the analyzer should be directly coupled to the test equipment.

(4) Allow a warm-up time of half an hour before commencing tests.

(5) Before each test select the 'preset' and 'calibrated' operating conditions of the analyzer by pressing the PRESET and CAL keys. Every subsequent 10 minutes the CAL key must be pressed again to maintain calibration.

-TEST PROCEDURES-

## FREQUENCY SPAN, /DIV and LOG

3. This tests the display accuracy in the /DIV mode. If it is correct the less stringent display accuracy in LOG mode can be assumed to be correct also.

| SPECIFICATION | |
|---|---|
| Frequency span, /DIV: | ±1% of full span ±1% separation |
| LOG: | ±5N% where N = number of decades selected |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generators | Frequency range: 5 Hz to 1 MHz<br>Output level: -40 dBm to +10 dBm | HP 3325A |
| | Frequency range: 1 MHz to 1 GHz<br>Output range: -40 dBm to +10 dBm | Marconi 2019A |

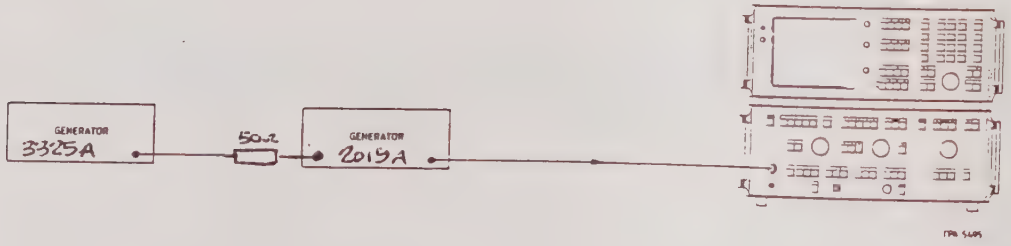


Fig. 1 Frequency span test set-up.

### Procedure

(1) Connect the generator output to the analyzer INPUT. Connect the 3325A output to the 2019A EXT MOD input via a 50 ohm load.

(2) On the 2019A generator select:

| | |
|---|---|
| Carrier frequency ..... | 7.38 MHz |
| Output level ..... | -10 dBm |
| Incremental frequency..... | 550 kHz |
| AM modulation depth ..... | 50 % |
| External AM ..... | On |

On the 3325A generator select:

| | |
|---|---|
| Frequency | 80 kHz |
| Amplitude | 1 V rms |
| Function | SQUARE |

On the analyzer select:

PRESET
CAL

| | |
|---|---|
| REF FREQ | 7.5 MHz |
| SPAN/DIV | 20 kHz |
| INC FREQ | 550 kHz |

(3) The analyzer display should show three responses lined up with the 10%, 50% and 90% graticule lines.

(4) On the analyzer select:

PEAK FIND

(5) The marker frequency should read 7.4200 MHz as in line 1, column 3 of Table 1 and to within the limits shown on the bottom line under the same column.

(6) On the analyzer select:

NEXT PEAK (2nd FUNCT - PEAK FIND)

(7) The marker should jump to the 50% response and its frequency should read 7.5000 MHz to within ±2.8 kHz.

(8) On the analyzer select:

NEXT PEAK (2nd FUNCT - PEAK FIND)

(9) The marker should jump to the 90% response and its frequency should read 7.5800 MHz to within ±2.8 kHz.

(10) On the analyzer select:

REF FREQ ..... ↑

(11) Increment the 2019A signal generator frequency by 550 kHz, press PEAK FIND and repeat from (5) above using the information in line 2 of Table 1.

(12) Step through each successive line of Table 1 by incrementing the analyzer reference frequency and the generator by 550 kHz and check each response for correct position and frequency.

(13) On the 2019A generator select:

Carrier frequency ..... 7.48 MHz

On the 3325A generator select:

Carrier frequency ..... 20 kHz

On the analyzer select:

REF FREQ ..... 7.5 MHz
SPAN/DIV ..... 5 kHz
RESOLUTION BANDWIDTH ..... 300 Hz

(14) Step through each line of Table 2 by incrementing the generator frequency and analyzer reference frequencies to the values shown and check each response for correct position and frequency.

(15) On the 2019A generator select:

Frequency ..... 7.492 MHz
Incremental frequency ..... 520 kHz

On the 3325A generator select:

Frequency ..... 8 kHz

On the analyzer select:

REF FREQ ..... 7.500 MHz
SPAN/DIV ..... 2 kHz
INC FREQ ..... 520 kHz

(16) Step through each line of Table 3 by incrementing the generator frequency and analyzer reference frequencies to the values shown and check each response for correct position and frequency.

(17) On the 2019A generator select:

Frequency ..... 7.4992 MHz
Incremental frequency ..... 502 kHz

On the 3325A generator select:

Frequency ..... 800 Hz

On the analyzer select:

REF FREQ ..... 7.5000 MHz
SPAN/DIV ..... 200 Hz
INC FREQ ..... 502 kHz

(18) Step through each line of Table 4 by incrementing the generator frequency and analyzer reference frequencies to the values shown and check each response for correct position and frequency.

TABLE 1 DISPLAY ACCURACY at 20 kHz/div (auto coupled)

| 2383 REF Frequency (MHz) | 2019A REF Frequency (MHz) | MARKER readout frequency (MHz) position as a % of full span (10%) | (50%) | (90%) |
|---|---|---|---|---|
| 7.50 | 7.42 | 7.4200 | 7.5000 | 7.5800 |
| 8.05 | 7.97 | 7.9700 | 8.0500 | 8.1300 |
| 8.60 | 8.52 | 8.5200 | 8.6000 | 8.6800 |
| 9.15 | 9.07 | 9.0700 | 9.1500 | 9.2300 |
| 9.70 | 9.62 | 9.6200 | 9.7000 | 9.7800 |
| 10.25 | 10.17 | 10.1700 | 10.2500 | 10.3300 |
| 10.80 | 10.72 | 10.7200 | 10.8000 | 10.8800 |
| 11.35 | 11.27 | 11.2700 | 11.3500 | 11.4300 |
| 11.90 | 11.82 | 11.8200 | 11.9000 | 11.9800 |
| LIMITS +/- | | 2.8 kHz | 2.8 kHz | 2.8 kHz |

TABLE 2 DISPLAY ACCURACY at 5 kHz/div, 300 Hz Resolution Bandwidth

| 2383 REF Frequency (MHz) | 2019A REF Frequency (MHz) | MARKER readout frequency (MHz) position as a % of full span (10%) | (50%) | (90%) |
|---|---|---|---|---|
| 7.50 | 7.48 | 7.4800 | 7.5000 | 7.5200 |
| 8.05 | 8.03 | 8.0300 | 8.0500 | 8.0700 |
| 8.60 | 8.58 | 8.5800 | 8.6000 | 8.6200 |
| 9.15 | 9.13 | 9.1300 | 9.1500 | 9.1700 |
| 9.70 | 9.68 | 9.6800 | 9.7000 | 9.7200 |
| 10.25 | 10.23 | 10.2300 | 10.2500 | 10.2700 |
| 10.80 | 10.78 | 10.7800 | 10.8000 | 10.8200 |
| 11.35 | 11.33 | 11.3300 | 11.3500 | 11.3700 |
| 11.90 | 11.88 | 11.8800 | 11.9000 | 11.9200 |
| LIMITS +/- | | 700 Hz | 700 Hz | 700 Hz |

TABLE 3 DISPLAY ACCURACY at 2 kHz/div, 300 Hz Resolution Bandwidth

| 2383 REF Frequency (MHz) | 2019A REF Frequency (MHz) | MARKER readout frequency (MHz) position as a % of full span (10%) | (50%) | (90%) |
|---|---|---|---|---|
| 7.50 | 7.492 | 7.49200 | 7.50000 | 7.50800 |
| 8.02 | 8.012 | 8.01200 | 8.02000 | 8.02800 |
| 8.54 | 8.532 | 8.53200 | 8.54000 | 8.54800 |
| 9.06 | 9.052 | 9.05200 | 9.06000 | 9.06800 |
| 9.58 | 9.572 | 9.57200 | 9.58000 | 9.58800 |
| 10.10 | 10.092 | 10.09200 | 10.10000 | 10.10800 |
| 10.62 | 10.612 | 10.61200 | 10.62000 | 10.62800 |
| 11.14 | 11.132 | 11.13200 | 11.14000 | 11.14800 |
| 11.66 | 11.652 | 11.65200 | 11.66000 | 11.66800 |
| LIMITS +/- | | 220 Hz | 220 Hz | 220 Hz |

TABLE 4 DISPLAY ACCURACY at 200 Hz/div, 30 Hz Resolution Bandwidth

| 2383 REF Frequency (MHz) | 2019A REF Frequency (MHz) | MARKER readout frequency (MHz) position as a % of full span (10%) | (50%) | (90%) |
|---|---|---|---|---|
| 7.500 | 7.4992 | 7.499200 | 7.500000 | 7.500800 |
| 8.002 | 8.0012 | 8.001200 | 8.002000 | 8.002800 |
| 8.504 | 8.5032 | 8.503200 | 8.504000 | 8.504800 |
| 9.006 | 9.0052 | 9.005200 | 9.006000 | 9.006800 |
| 9.508 | 9.5072 | 9.507200 | 9.508000 | 9.508800 |
| 10.010 | 10.0092 | 10.009200 | 10.010000 | 10.010800 |
| 10.512 | 10.5112 | 10.511200 | 10.512000 | 10.512800 |
| 11.014 | 11.0132 | 11.013200 | 11.014000 | 11.014800 |
| 11.516 | 11.5152 | 11.515200 | 11.516000 | 11.516800 |
| LIMITS +/- | | 28 Hz | 28 Hz | 28 Hz |

## EXTERNAL STANDARD INPUT

4. This tests the ability of the analyzer to lock to an external standard.

| SPECIFICATION | |
|---|---|
| Ext. standard input: | The system will lock to an external standard signal of 1, 2, 5 or 10 MHz at a level between -15 and +15 dBm. The frequency must be within ±1 part in $10^6$ for the system to lock. |

TEST EQUIPMENT

| Description | Minimum specification | Example |
|---|---|---|
| Generator | Frequency range: 1 MHz to 1 GHz<br>Output level: -40 dBm to +10 dBm | Marconi 2019A |
| Power meter | Frequency range: 30 kHz to 4.2 GHz<br>Accuracy: ±0.02 dBm | Marconi 6960 & 6912 sensor |
| RF power splitter | Frequency range: d.c. to 4.2 GHz<br>Impedance: 50 Ω | Weinschel 1870A |
| RF amplifier | Frequency range: 1 MHz to 1 GHz<br>Gain: 40 dB | Marconi 2177 |

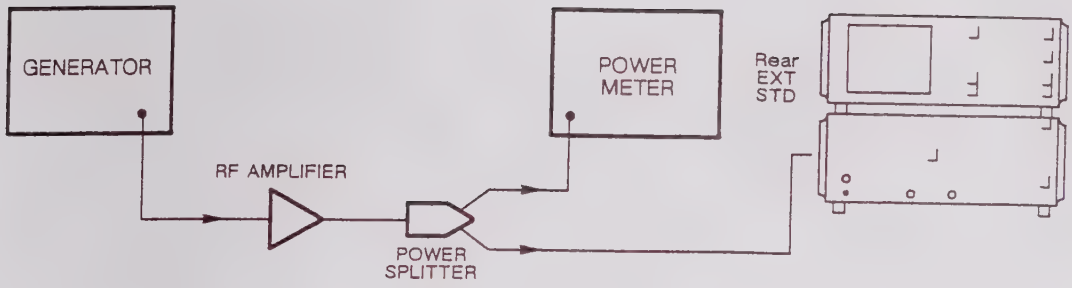


Fig. 2 External standard input test set-up.

Procedure

(1) Connect the power meter sensor and the EXT STD input on the rear of the analyzer to the respective outputs of the power splitter.

(2) Set the generator frequency to precisely 1 MHz at an output level of -60 dBm. Connect the generator via the RF amplifier to the input of the power splitter. Adjust the generator level until the power meter reads +15 dBm.

External standard locking is indicated by the 'ext std' annotation on the screen; if lock is not achieved the annotation remains flashing.

(3) Check that the external standard locks for each of the values given in Table 5.

TABLE 5 EXTERNAL STANDARD LOCKING POINTS

| EXT STD INPUT | |
|---|---|
| Freq (MHz) | Level (dBm) |
| 10.0 | +15 |
| 10.000050 | 0 |
| 9.999950 | 0 |
| 10.0 | -15 |
| 1.0 | -15 |

REFERENCE FREQUENCY, /DIV

5.

| SPECIFICATION | |
|---|---|
| Accuracy: | ±[freq. std. error +2% of selected sweep span + oscillator drift] Hz |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 1 GHz to 4.2 GHz<br>Output range : -40 dBm to +10 dBm | Wiltron 6700A |

Fig. 3 Reference frequency test set-up.

Procedure

(1) Connect the generator output to the analyzer INPUT.

(2) On the generator select 2 GHz at -10 dBm.

On the analyzer select:

PRESET
CAL
REF FREQ ..... 2 GHz

(3) Set SPAN/DIV, SWEEP TIME and RESOLUTION BANDWIDTH as in line 1 of Table 6 and trigger a single sweep on the analyzer.
Then press PEAK FIND and note that the response frequency shown by the Mkr1 annotation is 2.000 GHz ±40 MHz.

(4) Repeat step (3) for each set of values in Table 6 and check that the frequency is within the limits shown.

TABLE 6 REFERENCE FREQUENCY TEST POINTS

| SPAN/DIV | RESOLUTION BANDWIDTH | SWEEP TIME/DIV | LIMITS (±) |
|---|---|---|---|
| 200 MHz | 1 MHz | 20 mS | 40 MHz |
| 100 MHz | 1 MHz | 10 mS | 20 MHz |
| 50 MHz | 1 MHz | 10 ms | 10 MHz |
| 20 MHz | 1 MHz | 10 ms | 4 MHz |
| 10 MHz | 300 kHz | 10 ms | 2 MHz |
| 5 MHz | 100 kHz | 10 ms | 1 MHz |
| 2 MHz | 100 kHz | 10 ms | 400 kHz |
| 1 MHz | 30 kHz | 10 ms | 200 kHz |
| 0.5 MHz | 30 kHz | 10 ms | 100 kHz |
| 200 kHz | 10 kHz | 10 ms | 40 kHz |
| 100 kHz | 10 kHz | 10 ms | 20 kHz |
| 50 kHz | 3 kHz | 20 ms | 10 kHz |
| 20 kHz | 3 kHz | 10 ms | 4 kHz |
| 10 kHz | 1 kHz | 50 ms | 2 kHz |
| 5 kHz | 1 kHz | 20 ms | 1 kHz |
| 2 kHz | 300 Hz | 100 ms | 400 Hz |
| 1 kHz | 100 Hz | 500 ms | 200 Hz |
| 500 Hz | 100 Hz | 200 ms | 100 Hz |
| 200 Hz | 30 Hz | 1.0 s | 40 Hz |
| 100 Hz | 10 Hz | 5.0 s | 20 Hz |
| 50 Hz | 10 Hz | 2.0 s | 10 Hz |

FREQUENCY COUNT

6.

| SPECIFICATION | |
|---|---|
| Frequency count: | ±Frequency standard error ±2 x resolution. (with the marker at least 20 dB out of noise and 3 dB bandwidth >0.2% of span) |
| Resolution: | ±100 kHz from 500 kHz/div to 420 MHz/div, ±100 Hz from 200 Hz/div to 200 KHz/div, ±1 Hz from 10 Hz/div to 100 Hz/div. |

| TEST EQUIPMENT |
|---|
| - none required - |

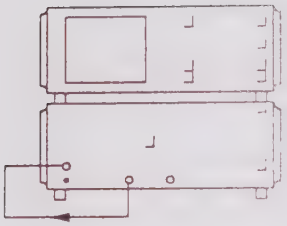

Fig. 4 Frequency count test set-up

Procedure

(1) Connect the STD 50 MHz OUTPUT to the INPUT.
On the analyzer select:

PRESET
CAL
REF FREQ..... 50 MHz
SPAN/DIV..... 20 MHz
RESOLUTION BANDWIDTH..... 1 MHz
PEAK FIND
FREQ COUNT

Ensure that the marker readout is 50 MHz ±20 kHz.

(2) For the SPAN/DIV and RESOLUTION BANDWIDTH settings shown in Table 7 ensure that the marker readout after PEAK FIND has been pressed is within the limits shown in the last column.

TABLE 7 FREQUENCY COUNT LIMITS

| SPAN/DIV | RESOLUTION BANDWIDTH | LIMITS (±) |
|---|---|---|
| 20 MHz | 1 MHz | 200 kHz |
| 500 kHz | 10 kHz | 200 kHz |
| 200 kHz | 10 kHz | 200 Hz |
| 200 Hz | 100 Hz | 200 Hz |
| 100 Hz | 30 Hz | 2 Hz |
| 10 Hz | 10 Hz | 2 Hz |

RESOLUTION 1 Hz

7.

| SPECIFICATION |
|---|
| As for frequency count except resolution of 1 Hz for all spans |

| TEST EQUIPMENT |
| --- |
| - none required - |

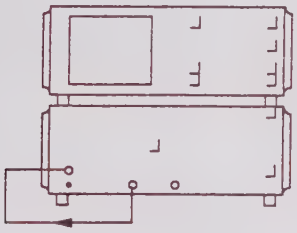

Fig. 5 Resolution 1 Hz test set-up.

Procedure

(1) Connect the STD 50 MHz OUTPUT to the INPUT.

On the analyzer select:

PRESET
CAL
REF FREQ..... 50 MHz
SPAN/DIV..... 20 MHz
RESOLUTION BANDWIDTH..... 1 MHz
PEAK FIND
Res 1Hz (2nd FUNCT - FREQ COUNT)

Ensure that the marker readout is 50 MHz ±1 Hz.

(2) For the SPAN/DIV and RESOLUTION BANDWIDTH settings in Table 8 ensure that the marker readout after PEAK FIND has been pressed is within the limits shown in the last column.

TABLE 8 1 Hz RESOLUTION TEST SETTINGS

| SPAN/DIV | RESOLUTION BANDWIDTH | LIMITS (±) |
| --- | --- | --- |
| 20 MHz | 1 MHz | 1 Hz |
| 500 kHz | 10 kHz | 1 Hz |
| 200 kHz | 10 kHz | 1 Hz |
| 200 Hz | 100 Hz | 1 Hz |
| 100 Hz | 30 Hz | 1 Hz |
| 10 Hz | 10 Hz | 1 Hz |

## RESOLUTION BANDWIDTHS

8.

| SPECIFICATION |
|---|
| 3 dB bandwidth: ±20% of nominal value (+0% -30% for 1 MHz filter)<br>Shape factor : <11:1 (<5:1 for 1 MHz filter) |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 1 MHz to 1 GHz | Marconi 2019A |

Fig. 6 Resolution bandwidths test set-up.

Procedure

(1) Connect the generator output to the analyzer INPUT.

On the generator select:

Carrier frequency ..... 10 MHz
Output level ..... 0 dBm

On the analyzer select:

PRESET
CAL
REF FREQ ..... 10 MHz
REF LEVEL ..... +2 dBm
dB/DIVISION ..... 0.5 dB
RESOLUTION BANDWIDTH ..... 1 MHz
SPAN/DIV ..... 100 kHz
PEAK FIND
MKR1 SETS REF LEVEL
dB RELATIVE
(2nd FUNCT - 0.5 dB VERTICAL/DIV)
SWEEP MODE ..... SINGLE ARM

(2) Move Mkr1 to the lower frequency 3 dB point and Mkr2 to the upper frequency 3 dB point. The ΔF annotation will give the 3 dB bandwidth which should be equal to 1 MHz within the limits +0 and -300 kHz as shown in Table 9. Record the result for future reference.

TABLE 9 RESOLUTION BANDWIDTHS

| RESOLUTION BANDWIDTH | A 3 dB SPAN/DIV | B 60 dB SPAN/DIV | 3 dB BANDWIDTH LIMITS | SHAPE FACTOR |
|---|---|---|---|---|
| 1 MHz | 100 kHz | 500 kHz | +0-300 kHz | < 5:1 |
| 300 kHz | 50 kHz | 500 kHz | ±60 kHz | <11:1 |
| 100 kHz | 20 kHz | 200 kHz | ±20 kHz | <11:1 |
| 30 kHz | 5 kHz | 50 kHz | ±6 kHz | <11:1 |
| 10 kHz | 2 kHz | 20 kHz | ±2 kHz | <11:1 |
| 3 kHz | 500 Hz | 5 kHz | ±600 Hz | <11:1 |
| 1 kHz | 200 Hz | 2 kHz | ±200 Hz | <11:1 |
| 300 Hz | 50 Hz | 500 Hz | ±60 Hz | <11:1 |
| 100 Hz | 20 Hz | 200 Hz | ±20 Hz | <11:1 |
| 30 Hz | 10 Hz | 50 Hz | ±6 Hz | <11:1 |
| 10 Hz | 10 Hz | 10 Hz | ±2 Hz | <11:1 |
| 3 Hz | 10 Hz | 10 Hz | ±1 Hz | <11:1 |

(3) Repeat (2) for each subsequent value of RESOLUTION BANDWIDTH and 3 dB SPAN/DIV (Column A) in the table and check that the 3 dB bandwidth is correct to within the limits shown.

(4) Change dB/DIVISION to 10 dB and measure the 60 dB bandwidth for each value of RESOLUTION BANDWIDTH and 60 dB SPAN/DIV (Column B) in the table. Record the result for future reference.

(5) For each filter calculate the shape factor $\left(= \frac{60 \text{ dB bandwidth}}{3 \text{ dB bandwidth}}\right)$

and check that it is within the limits shown.

## RESIDUAL FM

9.

| SPECIFICATION |
|---|
| Residual f.m.: <3 Hz peak-to-peak during a 10 second period for spans <2 kHz/div |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Crystal oscillator | Output level: 0 dBm<br>Output frequency: 100 MHz<br>Phase noise: <-90 dBm at 100 Hz offset | HCD185R |

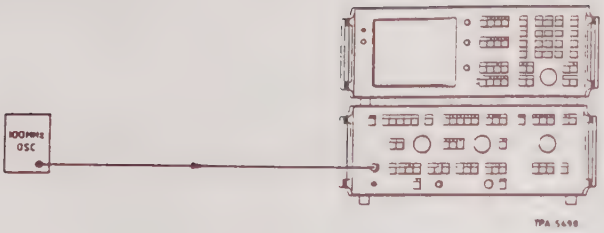

Fig. 7 Residual f.m. test set-up.

**Procedure**

(1) Connect the crystal oscillator to the analyzer INPUT.

On the analyzer select:

PRESET
CAL
REF FREQ ..... 100 MHz
SPAN/DIV ..... 200 Hz
PEAK FIND
MKR 1 SETS REF FREQ

(2) Adjust the REF LEVEL until the response is in the top 2 dB of the screen.

Select:

FM DEMOD (2ND FUNCT:ZERO SPAN)
SWEEP TIME ..... 1 s/DIV
RESOLUTION BANDWIDTH ..... 30 Hz

The total variation over full sweep should be less than 1 vertical division.

**DRIFT**

10.

| SPECIFICATION | |
|---|---|
| Drift: After a 1 hour warm-up | <20 Hz/min at 10 Hz/div increasing to<br><40 Hz/min at 2 kHz/div.<br><1 kHz/min at 5 kHz/div increasing to<br><2 kHz/min at 200 kHz/div.<br><100 kHz/min at 500 kHz/div.<br><200 kHz/min at 5 MHz/div and above. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Counter | Frequency range: 10 Hz to 4.2 GHz | Marconi 2440 |

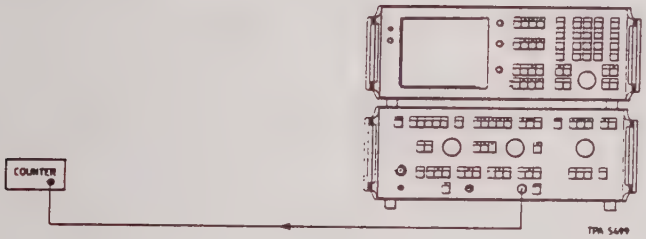


Fig. 8 Drift test set-up.

**Procedure**

(1) Allow the analyzer to warm up for at least 1 hour. Connect the TRACKING GENERATOR output to the counter input.

(2) On the analyzer select:

PRESET
CAL
REF FREQ ..... 2 GHz
SPAN/DIV ..... 500 kHz
HORIZONTAL ..... METER
TRACK GEN ..... On

Note the counter reading, wait 1 minute and note the reading again. The drift should be < 100 kHz.

(3) Repeat for SPAN/DIV 5 kHz and check that the drift is < 1 kHz.

(4) Repeat again for SPAN/DIV 500 Hz and check that the drift is < 20 Hz.

(5) Finally repeat for SPAN/DIV setting of 5 MHz and check that the drift is <200 kHz.

## DISPLAYED NOISE SIDEBANDS

11.

| SPECIFICATION | | |
|---|---|---|
| Displayed noise sidebands: | Displacement from carrier | Displayed noise to 1 Hz bandwidth |
| | 100 Hz | <-85 dBc |
| | 300 Hz | <-85 dBc |
| | 20 kHz | <-100 dBc |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| 100 MHz oscillator | Phase noise at 100 Hz : <-100 dBc/Hz<br>at 1 kHz: <-110 dBc/Hz<br>Output frequency : 100 MHz<br>Output level : 0 dBm | HCD185R |

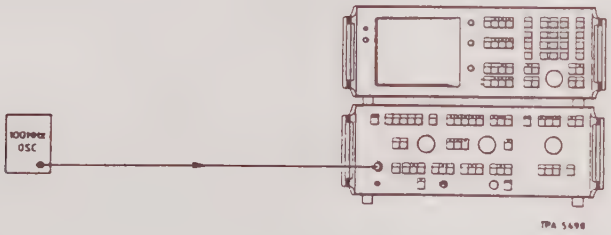


Fig. 9 Displayed noise sidebands test set-up.

### Procedure

(1) Connect the 100 MHz crystal oscillator to the analyzer INPUT and allow to stabilize.

(2) On the analyzer select:

PRESET
CAL
REF FREQ ..... 100 MHz
SPAN/DIV ..... 200 Hz
INC FREQ ..... 100 Hz
PEAK FIND
MKR 1 SETS REF LEVEL
MKR 1 SETS REF FREQ

dB RELATIVE (2ND FUNCT:
0.5 VERTICAL dB/DIVISION)
REF FREQ ↑
REF LEVEL ↓
RESOLUTION BANDWIDTH ..... 3 Hz

(3) Position marker at reference frequency origin.

Select NOISE 1 Hz (2nd FUNCT - MARKERS 1 2 MOVE)

The marker should read the equivalent of at least -85 dBc.

(4) Press REF FREQ ↑ twice

The marker should read the equivalent of -85 dBc.

(5) On the analyzer select:

INC FREQ ..... 19.7 kHz
REF FREQ FREQ ↑

The marker should read the equivalent of -100 dBc.

## OVERLOAD PROTECTION

12.

| SPECIFICATION |
|---|
| Overload protected to +47 dBm |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 1 MHz to 1 GHz<br>Output level: -40 dBm to +10 dBm | Marconi 2019A |
| | Frequency range: 1 GHz to 4.2 GHz<br>Output range: -40 dBm to +10 dBm | Wiltron 6700A |
| RF amplifiers | Frequency range: 1 MHz to 1 GHz<br>Gain: +40 dB | Marconi 2177 |
| | Frequency range: 1 GHz to 4.2 GHz<br>Gain: +30 dB | Mini-circuits ZHL-42 |

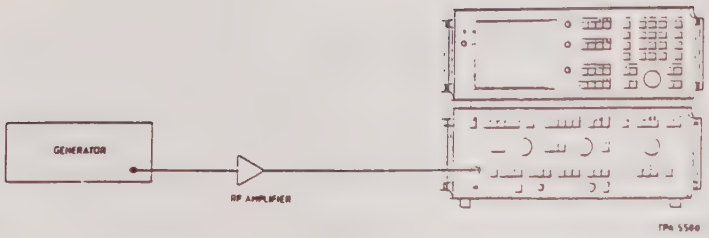


Fig. 10 Overload protection test set-up.

Procedure

(1) Connect the 2177 r.f. amplifier output to the analyzer INPUT.

(2) On the 2019A generator select:

| | |
|---|---|
| Carrier frequency | 100 MHz |
| Output level | -30 dBm |
| Incremental level | 1 dB |

On the analyzer select:

| | |
|---|---|
| REF LEVEL | +30 dBm |
| REF FREQ | 100 MHz |
| SPAN/DIV | 1 kHz |

(3) Connect the 2019A generator output to the r.f. amplifier input.

(4) On the analyzer select:

PEAK FIND

(5) Increase the generator level to give a marker level of +22 dBm. The analyzer should not register an overload.

(6) Increase the generator output by +7 dBm and check that the Overload annotation is displayed.

(7) Remove the input to the analyzer and press INTMD IDENT to remove the annotation and reset the overload protection.

(8) Reset the 2019A output level to -30 dBm.

(9) Repeat using the frequencies and test equipment shown in Table 10.

TABLE 10 OVERLOAD PROTECTION TEST SETTINGS

| 2383 REF FREQUENCY | TEST FREQUENCY | RF GENERATOR | RF AMPLIFIER |
|---|---|---|---|
| 100 MHz | 100 MHz | 2019A | 2177 |
| 1 GHz | 1 GHz | 2019A | 2177 |
| 2 GHz | 2 GHz | 6700A | ZHL-42 |
| 4 GHz | 4 GHz | 6700A | ZHL-42 |

## DISPLAY FIDELITY, DB/DIV AND VOLTS/DIV

13.

| SPECIFICATION | |
|---|---|
| dB/DIV: | departure from true logarithmic relationship less than 0.3 dB anywhere over the top 80 dB of display |
| VOLTS/DIV: | linearity better than ±2% of full-scale |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generators | Frequency range: 1 MHz to 1 GHz<br>Output level : -40 dBm to +10 dBm | Marconi 2019A |
| | Frequency range: 1 GHz to 4.2 GHz<br>Output level : -40 dBm to +10 dBm | Wiltron 6700A |
| Power meter | Frequency range: 30 kHz to 4.2 GHz<br>Accuracy : ±0.02 dBm | Marconi 6960 & 6912 sensor |
| RF amplifiers | Frequency range: 1 MHz to 1 GHz<br>Gain: +40 dB | Marconi 2177 |
| | Frequency range: 1 GHz to 4.2 GHz<br>Gain: +30 dB | Mini-circuits ZHL-42 |
| RF attenuator | 10 dB steps | HP 8495A |
| Power splitter | 50 Ω, d.c. to 4.2 GHz | Weinschel 1870A |

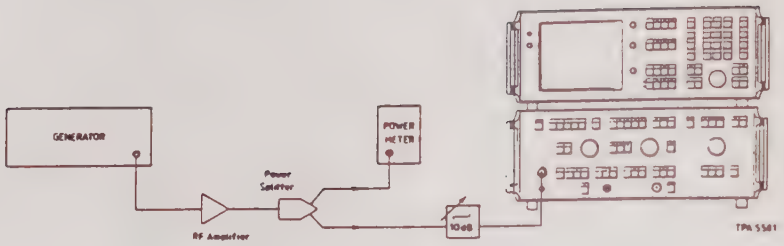


Fig. 11 Display fidelity test set-up.

## Procedure

(1) On the generator select a frequency of 10 MHz and an output level of -40 dB. Connect the generator via the amplifier to the power splitter input. Connect one output port on the power splitter to the power meter sensor, the other port to the analyzer INPUT via the 10 dB step attenuator.

(2) On the analyzer select:

PRESET
CAL
REF FREQ ..... 10 MHz
REF LEVEL ..... +10 dBm
SPAN/DIV ..... 500 Hz
HORIZONTAL ..... METER

(3) On the generator select a frequency of 10 MHz and adjust the output level to give +10 dBm on the screen. Note the power meter reading. Decrease the output level of the generator by 5 dB, checking correct reduction by use of the power meter. The readings should be -10 dBm ±0.3 dBm. Reduce the level in 5 dB steps to an input level of -10 dBm, noting marker readings at each step. All readings should be within ±0.3db of input level.

(4) Increase the output level of the generator to the original power meter reading. Introduce 20 dB of external attenuation. Repeat as above to an input level of -30 dBm.

(5) Increase the reference level of the generator to the initial power meter reading and introduce a further 20 dB of input attenuation. Repeat as previously to an input level of -50 dB.

(6) Adjust the generator output level to the initial power meter reading and introduce a further 20 dB of input attenuation. Repeat as above at a reference level on the screen of -70 dB.

## AMPLITUDE ACCURACY

14.

| SPECIFICATION | |
|---|---|
| dB/DIVISION accuracy: | At any frequency or resolution bandwidth, provided that the 'sweep uncal' message is not displayed, the amplitude accuracy is as follows: |
| RF input attenuation | 100 Hz (d.c. coupled)<br>5 MHz (a.c. coupled) |
| 0 & 5 dB | ±1 dB to 1.5 GHz ±1.5 dB to 4.2 GHz. |
| >10 dB | ±2 dB to 4.2 GHz. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generators | Frequency range : 5 Hz to 1 MHz<br>Output level : -40 dBm to +10 dBm | HP 3325 |
| | Frequency range : 1 MHz to 1 GHz<br>Output level : -40 dBm to +20 dBm | Marconi 2019A |
| | Frequency range : 1 GHZ to 4.2 GHz<br>Output level : -40 dB to +10 dBm | Wiltron 6700A |
| Power meter | Frequency range : DC to 50 MHz<br>Accuracy : ±0.01 dB | W & G EPM1 |
| | Frequency range : 30 kHz to 4.2 GHz<br>Accuracy : ±0.02 dB | Marconi 6960 & 6912 sensor |
| Power splitter | 50 Ω, d.c. to 4.2 GHz | Weinschel 1870A |
| RF attenuator | 10 dB steps | HP 8495A |

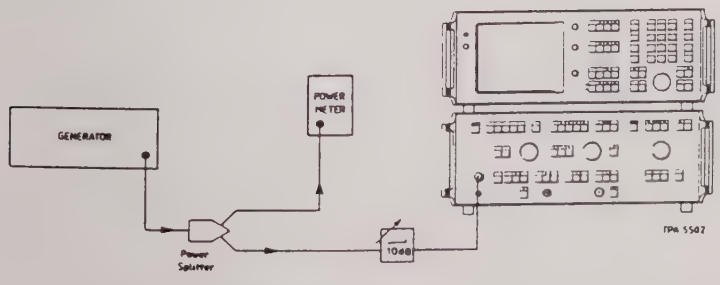


Fig. 12 Amplitude accuracy test set-up.

**Procedure**

(1) Connect the STD 50 MHz OUTPUT to the INPUT.

(2) On the analyzer select:

| | |
|---|---|
| PRESET | |
| CAL | |
| REF FREQ | 50 MHz |
| REF LEVEL | -8 dBm |
| SPAN/DIV | 10 Hz |
| dB/DIVISION | 0.5 dB |
| B VIEW | On |
| VERTICAL A B SELECT | B |
| dB/DIVISION | 0.5 dB |
| RESOLUTION BANDWIDTH | 1 kHz |
| B SAVE | On |
| VERTICAL A B SELECT | A |

(3) Select each of the filters in turn and measure their amplitudes relative to the 1 kHz filter by use of MARKERS AB SELECT and PEAK FIND. Note each of the relative amplitudes. From these figures calculate the filter that has the greatest value relative to the 1 kHz filter and the one which has the least value relative to the 1 kHz filter.

(4) On the 3325A generator select:

| | |
|---|---|
| FREQUENCY | 100 Hz |
| OUTPUT LEVEL | -40 dBm |

(5) Connect the 3325A generator to the power splitter input. Connect the power meter to one output port and the attenuator onto the other output port of the power splitter. Attach the attenuator output onto the analyzer INPUT.

(6) Using the 3325A generator select a carrier frequency of 100 Hz, levelled to 0 dBm.

(7) On the external attenuator select 20 dB attenuation.

On the analyzer select:

| | |
|---|---|
| PRESET | |
| CAL | |
| REF FREQ | 100 Hz |
| REF LEVEL | +10 dBm |
| SPAN/DIV | 10 Hz |

(8) Select the greatest filter and measure the response level using MKR1 and PEAK FIND. Repeat using the least filter. Both readings should be 20 dB ±1 dB.

(9) For each of the generator frequencies and the analyzer reference frequencies shown in Table 11, level the generator to 0 dBm using the power meter and measure the response level using the calculated filters.

TABLE 11 AMPLITUDE ACCURACY FREQUENCIES

| GENERATOR and ANALYZER FREQUENCIES | | | |
|---|---|---|---|
| (MHz) | (MHz) | (MHz) | (MHz) |
| 5 | 840 | 1960 | 3080 |
| 20 | 980 | 2100 | 3220 |
| 50 | 1120 | 2240 | 3360 |
| 140 | 1260 | 2380 | 3500 |
| 280 | 1400 | 2520 | 3640 |
| 420 | 1540 | 2660 | 3780 |
| 560 | 1680 | 2880 | 3920 |
| 700 | 1820 | 2940 | 4060 |
| | | | 4200 |

(10) Repeat the procedure for the reference levels and external attenuator settings shown in Table 12.

TABLE 12 AMPLITUDE ACCURACY REFERENCE LEVELS

| ANALYZER REFERENCE LEVEL (dBm) | EXTERNAL ATTENUATOR (dB) | MARKER READING ±1 dB |
|---|---|---|
| +10 | 20 | -20 |
| 0 | 20 | -20 |
| -10 | 30 | -30 |
| -20 | 30 | -30 |
| -30 | 40 | -40 |
| -40 | 40 | -40 |

**FREQUENCY RESPONSE**

15.

| SPECIFICATION | |
|---|---|
| Frequency response: | On all displayed ranges the frequency response is as follows: |
| RF input attenuation | 100 Hz (d.c. coupled)<br>5 MHz (a.c. coupled) |
| 0 & 5 dB | ±0.6 dB to 1.5 GHz ±0.9 dB to 4.2 GHz. |
| >10 dB | ±0.4 dB to 1.5 GHz ±0.7 dB to 4.2 GHz. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generators | Frequency range : 5 Hz to 1 MHz<br>Output level : -40 dBm to +10 dBm<br>Frequency range : 1 MHz to 1 GHz<br>Output level : -40 dBm to +20 dBm<br>Frequency range : 1 GHZ to 4.2 GHz<br>Output level : -40 dB to +10 dBm | HP 3325<br>Marconi 2019A<br>Wiltron 6700A |
| Power meter | Frequency range : DC to 50 MHz<br>Accuracy : ±0.01 dB<br>Frequency range : 30 kHz to 4.2 GHz<br>Accuracy : ±0.02 dB | W & G EPM1<br>Marconi 6960 & 6912 sensor |
| Power splitter | 50 Ω, d.c. to 4.2 GHz | Weinschel 1870A |
| RF attenuator | 10 dB steps | HP 8495A |

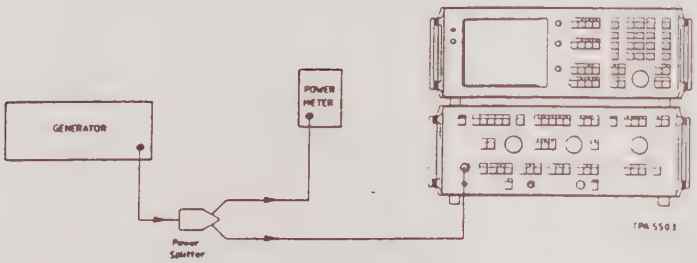


Fig. 13 Frequency response test set-up.

Procedure

(1) Connect the generator as required to the power splitter input, and the power meter and analyzer to the power splitter outputs.

On the analyzer select:

PRESET
CAL
REF FREQ ..... 10 MHz
REF LEVEL ..... -8 dBm
dB/DIVISION ..... 0.5 dB
RF ATTEN ..... 0 dB
SPAN/DIV ..... 1 kHz

(2) On the generator select 10 MHz and adjust the output level until the response on the analyzer is -10 dBm. Note the power meter reading.

(3) For each of the generator and analyzer frequencies shown in Table 13 adjust the output so as to read the value for the 10 MHz level on the power meter as recorded in (2) above.

(4) On the analyzer use MKR1 and PEAK FIND to obtain the level at each frequency. This should be -10 dBm ±0.5 dB.

(5) Repeat for 20 dB of input attenuation. The levels should be -10 dBm ±0.4 dB.

TABLE 13 FREQUENCY RESPONSE TEST SETTINGS

| GENERATOR and ANALYZER FREQUENCIES (MHz) | | | |
|---|---|---|---|
| 5 | 840 | 1960 | 3080 |
| 20 | 980 | 2100 | 3220 |
| 50 | 1120 | 2240 | 3360 |
| 140 | 1260 | 2380 | 3500 |
| 280 | 1400 | 2520 | 3640 |
| 420 | 1540 | 2660 | 3780 |
| 560 | 1680 | 2880 | 3920 |
| 700 | 1820 | 2940 | 4060 |
| | | | 4200 |

## INPUT REFLECTION COEFFICIENT

16.

| SPECIFICATION | | |
|---|---|---|
| Return loss (Reflection coefficient): | | |
| RF input attenuation | 100 Hz (d.c. coupled)<br>5 MHz (a.c. coupled) | |
| 0 & 5 dB | >14 dB(0.2) to 1.5 GHz; >7 dB(0.4) to 4.2 GHz. | |
| >10 dB | >20 dB(0.1) to 1.5 GHz; >14 dB(0.2) to 4.2 GHz. | |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Sweep generator | Frequency range : 10 MHz to 4.2 GHz<br>Output range : +5 dBm | Marconi 6311 |
| Amplitude analyzer | Frequency range : 10 MHz to 4.2 GHz | Marconi 6500 |
| Bridge | Frequency range : 10 MHz to 4.2 GHz | Wiltron 62N50-2 |

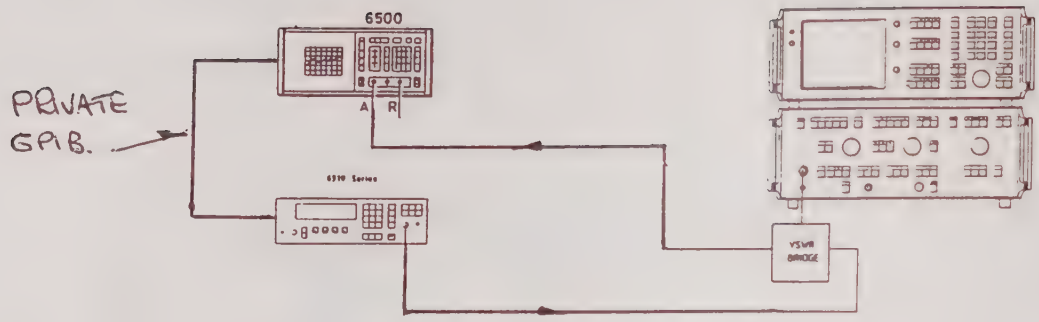


Fig. 14 Input reflection coefficient test set-up.

## Procedure

(1) Switch on the 6500 then the 6311. The 6311 will then control the 6500 via the 'private' GPIB interface.

(2) On the 6311 sweeper select:

| | |
|---|---|
| F1 ..... | 10 MHz |
| F2 ..... | 1.5 GHz |
| P1 ..... | +5.00 dBm |
| TIME ..... | 1 Second |

On the 6500 analyzer select:

| | |
|---|---|
| MODE ..... | A |
| DATUM ..... | +5.00 dBm |
| RANGE ..... | 5 dB/div |

On the 2383 analyzer select:

| | |
|---|---|
| REF FREQ ..... | 0 Hz |
| RF ATTEN ..... | 0 dB |
| INPUT COUPLING ..... | AC |
| ZERO SPAN | |

(3) Connect the open circuit to the Autotester bridge test port and then press STORE : A on the 6500.

(4) Remove the open circuit and then connect the short circuit to the test port. Press SHIFT : STORE : A on the 6500.

This stores the reference level in memory A of the 6500.

(5) Connect the Autotester to the input socket of the 2383. Press SUB MEM A on the 6500.

(6) Press MAX on the 6500. The Marker on the screen indicates the level of the highest peak which corresponds to the worst case return loss which should be greater than 15 dB below 10 dB attenuation, and greater than 22 dB for 10 dB attenuation and above.

(7) Repeat (6) for all attenuator settings.

(8) On the 6311 sweeper select:

F1 ..... 1.5 GHz
F2 ..... 4.2 GHz

(9) Repeat (3) to (7) above checking for greater than 8 dB return loss below 10 dB attenuation and greater than 15 dB return loss for 10 dB attenuation and above.

## LOCAL OSCILLATOR LEAKAGE

17.

| SPECIFICATION |
|---|
| Leakage: Typically <-80 dBm at 10 dB attenuator setting and at any frequency. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer | Frequency range: 1 GHz to 4.2 GHz | Anritsu MS 710C |

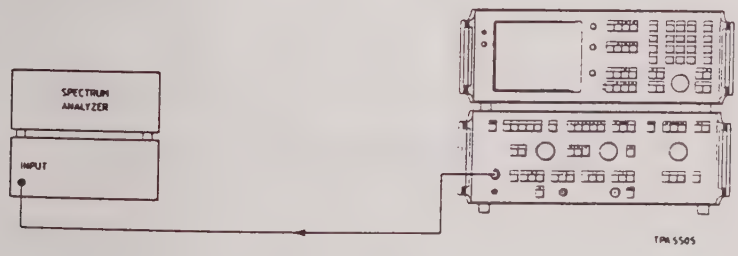


Fig. 15 Local oscillator leakage test set-up.

### Procedure

(1) Connect the 2383 analyzer INPUT to the test analyzer r.f. input.

On the 2383 select:

PRESET
CAL
REF FREQ ..... 0 MHz
RF ATTEN ..... 10 dB
ZERO SPAN

(2) Tune the MS 710C to 4.9026 GHz with a span/div of 10 kHz, reference level of -20 dBm and check that any signal at this frequency is below -80 dBm.

## HARMONIC DISTORTION

18.

| SPECIFICATION | |
|---|---|
| Harmonic distortion: | With a sinusoidal signal at -40 dBm at the input mixer any internally generated harmonic distortion products will be >70 dB down on the fundamental |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| 100 MHz crystal oscillator | Harmonics : >40 dB down on fundamental | HCD185R |
| 100 MHz low-pass filter | Attenuation : >50 dB at 200 MHz.<br>Cut-off frequency: 100 MHz | Telonic TCP100 48B |

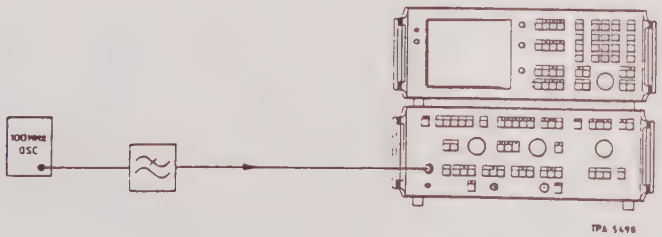


Fig. 16 Harmonic distortion test set-up.

### Procedure

(1) Connect the 100 MHz oscillator via the low-pass filter to the analyzer INPUT.

On the analyzer select:

PRESET
CAL
REF FREQ ..... 100 MHz
SPAN/DIV ..... 200 Hz

(2) Adjust the oscillator output until it is at the top of the screen.

(3) On the analyzer select:

PEAK FIND
MKR1 SETS REF FREQ
MKR1 SETS INC FREQ
REF FREQ ↑
SPAN/DIV ..... 10 Hz

(4) Pressing INTMD IDENT should display 'input level of 0 dBm gives mixer level of -40 dBm.'

On the analyzer select:

SWEEP MODE ..... SINGLE ARM

After completion of the sweep press PEAK FIND.

(5) The marker reading should be at least 70 dB below the carrier (i.e. at least -70 dBm).

(6) On the analyzer select:

REF FREQ ↑
SWEEP MODE ..... SINGLE ARM

After completion of the sweep press PEAK FIND.

(7) The marker reading should again be at least -70 dBm.

(8) On the analyzer select:

REF FREQ ↑
SWEEP MODE ..... SINGLE ARM

After completion of the sweep press PEAK FIND.

(9) The marker reading again should be at least -70 dBm.

## NON-HARMONIC DISTORTION

19.

| SPECIFICATION | |
|---|---|
| Non-harmonic distortion: | With a sinusoidal signal at -40 dBm at the input mixer any internally generated non-harmonic distortion products will be >70 dB down on signal |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 1 GHz to 4.2 GHz<br>Output level : -40 dBm to +10 dBm | Wiltron 6700A |

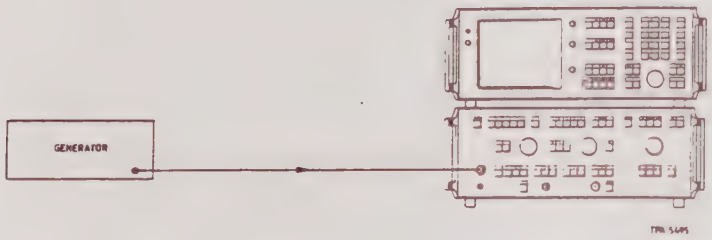


Fig. 17 Non-harmonic distortion test set-up.

Procedure

(1) Connect the generator to the analyzer INPUT.

On the generator select:

Carrier frequency ..... 3505.910 MHz
Reference level ..... 0 dBm

(2) On the analyzer select:

PRESET
CAL
REF FREQ ..... 3505.910 MHz
SPAN/DIV ..... 10 Hz

(3) Adjust the generator so that the response is at 0 dBm on the screen. Pressing INTMD IDENT should display ´input level of 0 dBm gives mixer level of -40 dBm´.

(4) On the analyzer select:

REF FREQ ..... 2500.71 MHz
RESOLUTION BANDWIDTH ..... 3 Hz

After completion of the sweep press PEAK FIND.

(5) The response should be at least -85 dBm.

(6) Repeat for generator and analyzer reference frequencies in Table 14.

TABLE 14 DISTORTION REFERENCE FREQUENCIES

| 6700A GENERATOR FREQUENCY (MHz) | 2383 REFERENCE FREQUENCY (MHz) |
|---|---|
| 3505.910 | 2500.71 |
| 2405.910 | 2500.71 |
| 2505.910 | 2500.71 |
| 2500.910 | 2500.71 |
| 2463.640 | 12.34 |
| 2563.640 | 112.34 |
| 2663.640 | 212.34 |
| 2763.640 | 312.34 |
| 2863.640 | 412.34 |
| 2963.640 | 512.34 |
| 3063.640 | 612.34 |
| 3163.640 | 712.34 |
| 3263.640 | 812.34 |
| 3363.640 | 912.34 |
| 3463.640 | 1012.34 |
| 3563.640 | 1112.34 |
| 3663.640 | 1212.34 |
| 3763.640 | 1312.34 |
| 3863.640 | 1412.34 |
| 3963.640 | 1512.34 |
| 4063.640 | 1612.34 |
| 4163.640 | 1712.34 |

## THIRD ORDER INTERMODULATION

20.

| SPECIFICATION |
|---|
| Third order intermodulation: -90 dBc for on-screen signals using 3 Hz filter at -40 dBm at the input mixer |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| 100 MHz crystal oscillator (2) | Output level : 0 dBm<br>Phase noise at 1 kHz: <-100 dBc | HCD 185R |
| Attenuators | 1 x 3 dB, 2 x 20 dB BNC connectors | Texscan FP-50 series |
| Combiner | Frequency : 100 MHz<br>Impedance : 50 Ω | Mini-Circuits ZFSC-2-1 |

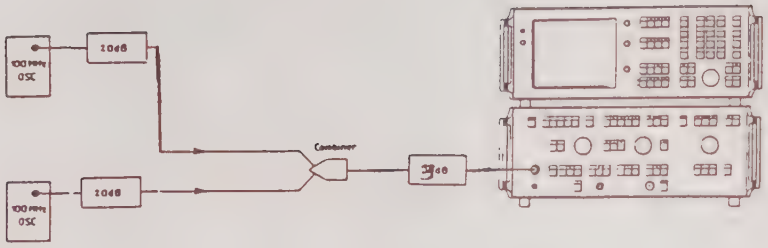


Fig. 18 Third order intermodulation test set-up.

Procedure

(1) Connect a 20 dB pad to each input of the combiner, connect the output of the combiner via a 3 dB pad to the input of the analyzer. Connect one crystal oscillator output to one of the 20 dB pads.

(2) On the analyzer select:

PRESET
CAL
REF FREQ ..... 100 MHz
REF LEVEL ..... -20 dBm
SPAN/DIV ..... 500 Hz

(3) Adjust the crystal output level for -20 dBm.

(4) On the analyzer select:

PEAK FIND
MKR1 SETS REF FREQ

(5) Connect the second oscillator to the other -20 dB pad input and adjust its frequency and level to give a response at -20 dBm, 1 division to the left of the centred response.

(6) On the analyzer select:

MKR 2 ..... On
1 2 MOVE ..... 2

Move Marker 2 on to the second response.

ΔF SETS INC FREQ
REF LEVEL ..... -30 dBm
SPAN/DIV ..... 10 Hz
RESOLUTION BANDWIDTH ..... 3 Hz
RF ATTEN ..... 0 dB
REF FREQ ..... ↑
HORIZONTAL ..... SINGLE ARM
MKR 2 ..... Off

(9) After completion of the sweep press PEAK FIND.

Any response should be below -90 dBm.

(10) On the analyzer select:

REF FREQ ..... Down (three times)
START

(11) After completion of the sweep press PEAK FIND.

Any response should be below -90 dBm.

## RESIDUAL RESPONSES

21.

| SPECIFICATION |
|---|
| Residual responses: <-110 dBm at 0 dB r.f. attenuation |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Type-N termination | Impedance: 50 Ω | Weinschel 1404 |

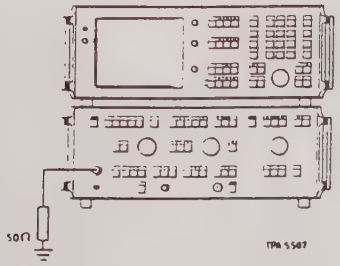


Fig. 19 Residual responses test set-up.

### Procedure

(1) Terminate the analyzer INPUT with the 50 Ω load.

On the analyzer select:

PRESET
CAL
REF LEVEL ..... -60 dBm

REF FREQ ..... 1 MHz
SPAN/DIV ..... 10 Hz
RF ATTEN ..... 0 dB
SWEEP MODE ..... SINGLE ARM

After completion of the sweep press PEAK FIND.

(2) The response should be <-120 dBm.

(3) Repeat for the reference frequencies shown in Table 15

TABLE 15 RESIDUAL RESPONSE FREQUENCIES

| REFERENCE FREQUENCIES (MHz) | | |
|---|---|---|
| 1.0000 | 796.5333 | 2263.2000 |
| 5.0000 | 880.3000 | 2451.3000 |
| 10.0000 | 1047.8333 | 2598.2667 |
| 15.0000 | 1131.6000 | 2671.7500 |
| 50.0000 | 1156.8800 | 2923.0500 |
| 54.1714 | 1225.6500 | 3268.4000 |
| 94.8000 | 1357.9200 | 3394.8000 |
| 146.9667 | 1446.1000 | 3646.1000 |
| 197.7714 | 1571.7500 | 3729.8667 |
| 276.8800 | 1634.2000 | 3771.7500 |
| 314.5000 | 1823.0500 | 4023.0500 |
| 417.7500 | 1948.7000 | 4064.9333 |
| 477.9200 | 2036.8800 | 4148.7000 |
| 723.0500 | 2237.9200 | |

## INPUT NOISE SENSITIVITY

22.

| SPECIFICATION |
|---|
| Sensitivity: <-134 dBm for reference frequencies 500 KHz to 1.5 GHz, increasing to -126 dBm at 4.2 GHz. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Type-N termination | Impedance: 50 Ω | Weinschel 1404 |

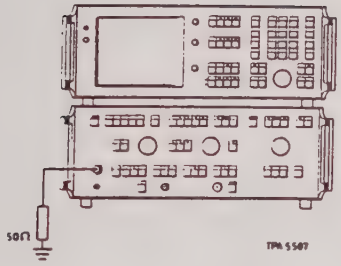


Fig. 20 Input noise sensitivity test set-up.

**Procedure**

(1) Terminate the INPUT with a 50 Ω load.

On the analyzer select:

PRESET
CAL
REF FREQ ..... 500 kHz
REF LEVEL ..... -50 dBm
SPAN/DIV ..... 10 Hz
RF ATTEN ..... 0 dB
RESOLUTION BANDWIDTH ..... 3 Hz
SWEEP MODE ..... SINGLE ARM

The average level of displayed noise should be <-134 dBm.

(2) Repeat using the frequencies shown in Table 16.

TABLE 16 NOISE SENSITIVITY TEST FREQUENCIES

| REFERENCE FREQUENCY (MHz) | MAXIMUM LEVEL (dBm) |
|---|---|
| 0.5 | -134 |
| 51.0 | -134 |
| 1500 | -134 |
| 2000 | -126 |
| 3000 | -126 |
| 4200 | -126 |

## TRACKING GENERATOR CROSS-COUPLING

23.

| SPECIFICATION | |
|---|---|
| Cross-coupling: | With the tracking generator switched on and both the input and the tracking generator output terminated in 50 Ω, the displayed noise level in a 3 Hz bandwidth is not >-125 dBm from 400 kHz to 1.5 GHz, and not >-105 dBm from 1.5 to 4.2 GHz. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| 2 x Type-N terminations | Impedance: 50 Ω | Weinschel 1404 |

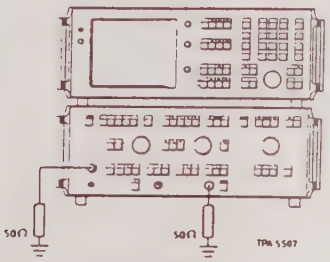


Fig. 21 Tracking generator cross-coupling test set-up.

### Procedure

(1) Terminate the INPUT and TRACKING GENERATOR output with 50 Ω.

On the analyzer select:

PRESET
CAL
REF FREQ ..... 0.4 MHz
REF LEVEL ..... -60 dBm
SPAN/DIV ..... 10 Hz
RF ATTEN ..... 0 dB
RESOLUTION BANDWIDTH ..... 3 Hz
TRACK GEN ..... On
SWEEP MODE ..... SINGLE ARM
PEAK FIND

The response should be at least -125 dBm.

(2) Repeat for the frequencies shown in Table 17.

TABLE 17 TG CROSS-COUPLING TEST SETTINGS

| REFERENCE FREQUENCY (MHz) | MAXIMUM LEVEL (dBm) |
|---|---|
| 0.4 | -125 |
| 1.03 | -125 |
| 3.03 | -125 |
| 10.03 | -125 |
| 30.03 | -125 |
| 100.03 | -125 |
| 200.03 | -125 |
| 600.03 | -125 |
| 1000 | -125 |
| 1400 | -125 |
| 1800 | -105 |
| 2200 | -105 |
| 2600 | -105 |
| 3000 | -105 |
| 3400 | -105 |
| 3800 | -105 |
| 4199.99 | -105 |

**EXTERNAL TRIGGER SOURCE**

24.

| SPECIFICATION | |
|---|---|
| External trigger source: | Sweep is triggered by external signals from the rear panel EXT TRIG BNC connector over the range 50 mV p-p to 100 V p-p from 10 Hz to 300 kHz |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 100 Hz to 1 MHz<br>Output level : -40 dBm to +20 dBm | HP3325 |

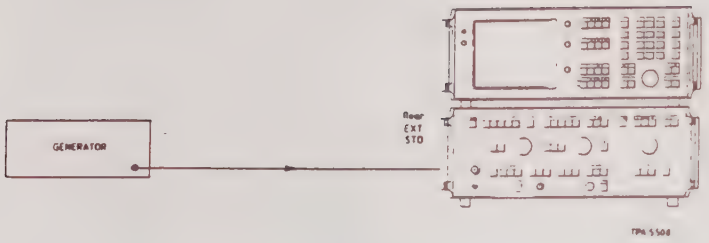


Fig. 22 External trigger source test set-up.

**Procedure**

(1) On the analyzer select:

TRIGGER SOURCE ..... EXT
AUTO TRIGGER ..... off

(2) Connect the 3325A via a 50 ohm load to the EXT TRIG input on the rear of the 2383 and check that the instrument sweeps continuously for each of the inputs shown in Table 18.

TABLE 18 EXTERNAL TRIGGER TEST SETTINGS

| FREQUENCY | LEVEL |
|---|---|
| 10 Hz | 50 mV p-p |
| 10 Hz | 5 V p-p |
| 6 kHz | 50 mV p-p |
| 6 kHz | 5 V p-p |
| 300 kHz | 50 mV p-p |
| 300 kHz | 5 V p-p |

**FM DEMOD DISPLAY ACCURACY**

25.

| SPECIFICATION |
|---|
| Accuracy: Deviation accuracy at zero deviation rate is ±20% f.s.d. ±1 Hz. Bandwidth depends upon selected filter |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 1 MHz to 1 GHz<br>Output level : -40 dBm to +10 dBm | Marconi 2019A |

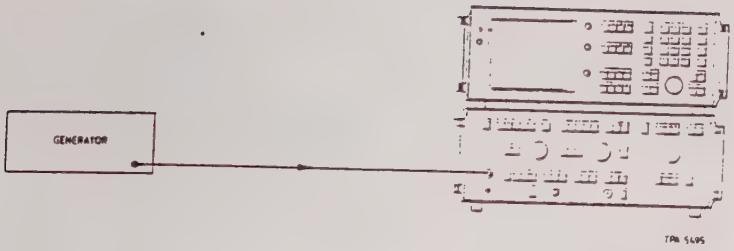


Fig. 23 FM demod display accuracy test set-up.

**Procedure**

(1) Connect the generator output to the analyzer INPUT.

On the generator select:

Frequency ..... 100 MHz
Output level ..... 0 dBm

On the analyzer select:

PRESET
CAL
REF FREQ ..... 100 MHz
SPAN/DIV ..... 100 kHz

(2) Adjust the generator level until the response is within the top 2 dB of screen. On the analyzer select:

FM DEMOD (2ND FUNCT:ZERO SPAN)
RESOLUTION BANDWIDTH ..... 1 kHz

Note the reading, increase the generator frequency by 1 kHz and check that the reading on the analyzer is the original value +1 kHz ±120 Hz.

## TRACKING GENERATOR FREQUENCY ACCURACY

26.

| SPECIFICATION |
|---|
| Accuracy: ±1 Hz referred to the tuned frequency |

| TEST EQUIPMENT |
|---|
| - None required - |

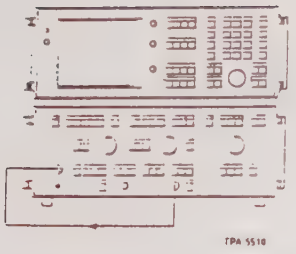

Fig. 24 Tracking generator frequency accuracy test set-up.

Procedure

(1) Connect the TRACKING GENERATOR output to the INPUT.

On the analyzer select:

| | |
|---|---|
| PRESET | |
| CAL | |
| REF FREQ ..... | 100 MHz |
| SPAN/DIV ..... | 10 Hz |
| RESOLUTION BANDWIDTH ..... | 30 Hz |
| TRACK GEN ..... | On |
| SWEEP MODE ..... | SINGLE ARM |
| START | |
| B VIEW ..... | On |
| B SAVE ..... | On |
| RESOLUTION BANDWIDTH ..... | 3 Hz |
| START | |

(2) On commencement of sweep press MKR1 ON. Toggle marker between A and B traces using MARKERS AB SELECT and ensure that level readout does not change by >0.5 dBm.

TRACKING GENERATOR FREQUENCY RESPONSE

27.

| SPECIFICATION | |
|---|---|
| Amplitude accuracy: | ±0.6 dB at -10 dBm at 50 MHz |
| Frequency response: | ±0.5 dB from 400 kHz to 1.5 GHz<br>±1 dB from 1.5 GHz to 4.2 GHz |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Power meter | Frequency : 30 kHz to 4.2 GHz<br>Accuracy : ±0.02 dB | Marconi 6960<br>& 6912 sensor |

Fig. 25 Tracking generator frequency response test set-up.

**Procedure**

(1) Connect the TRACKING GENERATOR output to the input of the power meter.

On the analyzer select:

PRESET
CAL
REF FREQ ..... 50 MHz
HORIZONTAL ..... ZERO SPAN
TRACK GEN ..... On

The power meter reading should be −10 dBm ±0.6 dB.

(2) Repeat for all of the frequencies shown in Table 19. Each reading taken up to 1.44 GHz should be within ±0.5 dB of the level at 50 MHz and within ±1 dB of the 50 MHz level up to 4.2 GHz.

TABLE 19 TG FREQUENCY RESPONSE TEST SETTINGS

| GENERATOR and ANALYZER FREQUENCIES (MHz) | | | |
|---|---|---|---|
| 0.5 | 720 | 2040 | 3360 |
| 1 | 840 | 2160 | 3480 |
| 2 | 960 | 2280 | 3600 |
| 5 | 1080 | 2400 | 3720 |
| 20 | 1200 | 2520 | 3840 |
| 50 | 1320 | 2640 | 3960 |
| 120 | 1440 | 2760 | 4080 |
| 240 | 1560 | 2880 | 4200 |
| 360 | 1680 | 3000 | |
| 480 | 1800 | 3120 | |
| 600 | 1920 | 3240 | |

## TRACKING GENERATOR AMPLITUDE SETTING

28.

| SPECIFICATION |
|---|
| Amplitude: -9.7 dBm to -20.3 dBm in 0.1 dB steps |

| TEST EQUIPMENT |
|---|
| - None required - |

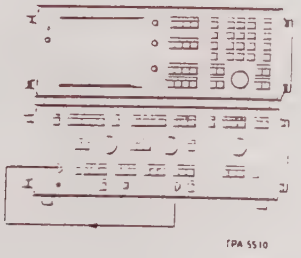


Fig. 26 Tracking generator amplitude test set-up.

**Procedure**

(1) Connect the TRACKING GENERATOR output to the INPUT.
On the analyzer select:

PRESET
CAL
REF FREQ ..... 10 MHz
SPAN/DIV ..... 10 kHz
TRACK GEN ..... On
SET TG (2ND FUNCT:REF LEVEL) . -9.7 dBm
PEAK FIND

(2) The marker should read -9.7 dBm ±0.5 dB and the annotation at the top of the screen should read -9.7 dBm.

(3) Select a tracking generator level of -20.3 dBm. The marker should read -20.3 dBm ±0.5 dB and the associated annotation should read -20.3 dBm.

## TRACKING GENERATOR DISTORTION

29.

| SPECIFICATION |
|---|
| Harmonics : all >25 dB down on the fundamental signal<br>Non-harmonic signals: all >30 dB down on the fundamental signal |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer | Frequency range: 1 GHz to 12 GHz | Anritsu MS710C |

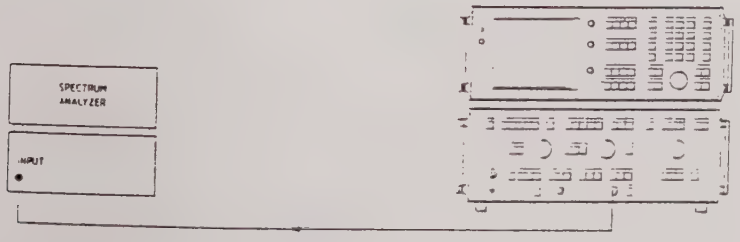


Fig. 27 Tracking generator distortion test set-up.

Procedure

(1) Connect the 2383 TRACKING GENERATOR output to the test analyzer input.

On the test analyzer select:

Frequency Band ..... 100 kHz to 2 GHz
Reference level ..... -10 dBm

On the 2383 select:

PRESET
CAL
TRACK GEN ..... On
HORIZONTAL ..... METER

(2) Rotate the MARKERS move control anticlockwise until the marker frequency readout shows 0 Hz.

(3) Slowly increase the marker position up to 600 MHz observing all harmonic signals are below -35 dBm (-25 dBc) and all non-harmonic signals are below -40 dBm (-30 dBc).

(4) On the test analyzer select:

FREQUENCY BAND ..... 1.7 GHz to 23 GHz
START ..... 1.7 GHz
STOP ..... 13 GHz
REFERENCE LEVEL ..... -10 dBm

(5) Continue to move the marker position up to 4.2 GHz again observing all harmonics are below -35 dBm (-25 dBc) and all non-harmonic content is below -40 dBm (-30 dBc)

TRACKING GENERATOR RETURN LOSS

30.

| SPECIFICATION |
|---|
| Return loss: >20 dB 400 kHz to 1.5 GHz.<br>>14 dB 1.5 GHz to 4.2 GHz. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Attenuators<br>Mismatch<br>Cable<br>Semi-rigid | N-type 10 dB attenuators (Qty. 2)<br>0.5 Ω resistor with N-type connectors<br>1.5 m of 50 Ω cable<br>0.75 m semi-rigid pipe with N-type male connectors | Marconi 6534/3<br>-<br>RG214<br>Suhner |

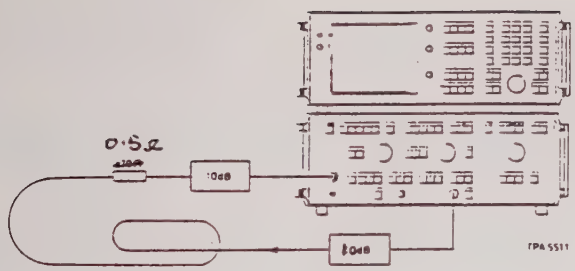


Fig. 28 Tracking generator return loss test set-up.

**Procedure**

(1) On the analyzer select:

| | |
|---|---|
| PRESET | |
| CAL | |
| REF LEVEL | -52 dBm |
| REF FREQ | 1.2 GHz |
| SPAN/DIV | 200 MHz |
| VERTICAL dB/DIVISION | 0.5 dB |
| VIDEO BANDWIDTH | 2.8 kHz |
| TRACK GEN | On |
| A VIDEO AVG | 8 sweeps |

(2) The 2380 display should display a screen similar to the diagram below. It may be necessary to adjust the rotary REF LEVEL control to centre the trace on the display.

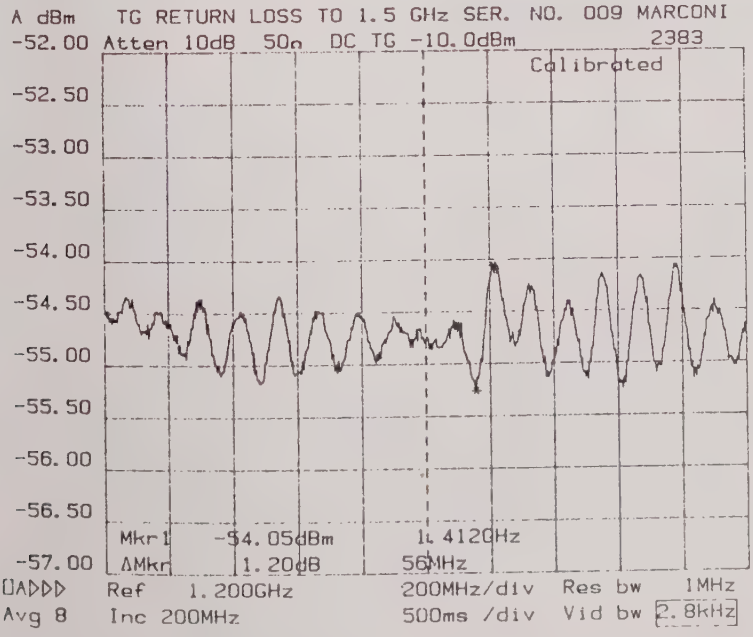


Fig. 29 Tracking generator return loss display.

(3) (i) Using the 2383 marker measure the amplitude of the highest peak below 1.5 GHz.

(ii) Measure the amplitude of the highest peak adjacent to the peak measured in (i) above ensuring that its frequency is again below 1.5 GHz.

(iii) Measure the amplitude of the trough between the two previously measured peaks.

(iv) Average measurements (i) and (ii) and then subtract measurement (iii).

(4) Check for a result of less than 1.4 dB, which corresponds to a return loss of 22 dB.

(5) Repeat the measurement process (3) for frequencies between 1.5 GHz and 2.2 GHz ensuring the result is less than 3.1 dB, corresponding to a return loss of 15 dB.

(6) On the analyzer select:

| | |
|---|---|
| A VIDEO AVG ..... | Off |
| REF LEVEL ..... | -50 dBm |
| REF FREQ ..... | 3.2 GHz |
| VERTICAL dB/DIVISION ..... | 1 dB |
| A VIDEO AVG ..... | 8 sweeps |

(7) Repeat the measurement process (3) and check the result is less than 3.1 dB, corresponding to a return loss of 15 dB.

## STANDARD 50 MHz OUTPUT FREQUENCY

31.

| SPECIFICATION |
|---|
| Frequency: 50 MHz ± standard frequency error |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Counter | Frequency range: 100 Hz to 4.2 GHz | Marconi 2440 |

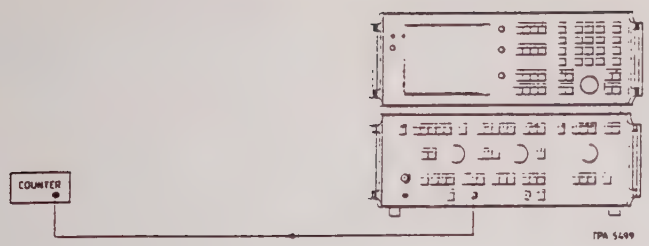


Fig. 30 Standard 50 MHz output frequency test set-up.

**Procedure**

(1) Connect the STD 50 MHZ OUTPUT to the counter input. Remove any standard input connected to the analyzer EXT STD socket.

The counter should read 50 MHz ±20 Hz.

## STANDARD 50 MHz OUTPUT AMPLITUDE

32.

| SPECIFICATION |
|---|
| Amplitude: -10 dBm ±0.3 dB |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Power meter | Frequency range: 30 kHz to 4.2 GHz<br>Accuracy : ±0.02 dB | Marconi 6960 & 6912 Sensor |

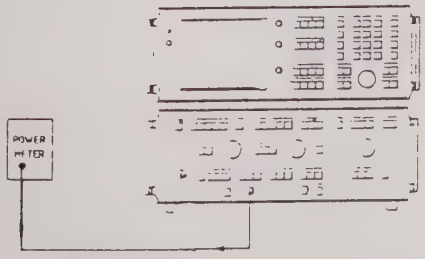


Fig. 31 Standard 50 MHz output amplitude test set-up.

**Procedure**

(1) Connect the power meter head input to the 50 MHz STD output.

(2) The power meter should read -10 dBm ±0.3 dB.

## 47.4 MHz OUTPUT

33.

| SPECIFICATION |
|---|
| Centre frequency: 47.4 MHz<br>Bandwidth : typically 3 MHz<br>Amplitude : nominally 5 dB greater than r.f. input signal for 0 dB r.f. attenuation. |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer | Frequency range: 100 Hz to 4.2 GHz | Marconi 2383 |

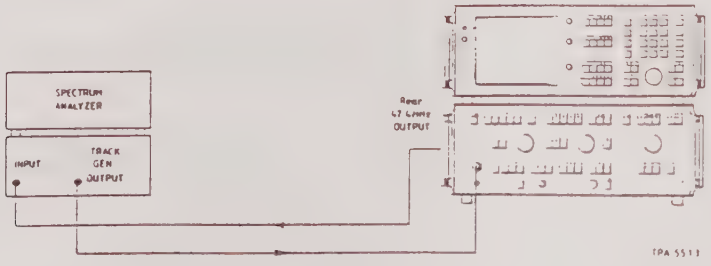


Fig. 32 47.4 MHz output test set-up.

**Procedure**

(1) Connect the test analyzer tracking generator output to the 2383 INPUT. Connect the 47.4 MHz OUTPUT at the rear of the 2383 to the analyzer input.

(2) On the test analyzer select:

| | |
|---|---|
| Reference frequency ..... | 47.4 MHz |
| Top of screen ..... | +5 dB |
| Horizontal scale ..... | 1 MHz/div |
| Vertical scale ..... | 10 dB/DIV |
| Tracking generator ..... | On |

(3) On the analyzer select:

REF FREQ ..... 47.4 MHz
RF ATTEN ..... 0 dB
HORIZONTAL ..... ZERO SPAN

The response displayed on the test analyzer should be centred on 47.4 MHz with a bandwidth of nominally 3 MHz. The peak level should be between 5 and 10 dB greater than the test analyzer tracking generator output level.

## DEMODULATED OUTPUT

34.

| SPECIFICATION |
|---|
| Dependent on vertical scale range, modulation depth and volume control setting. Signal level corresponding to a signal at the top of the screen is nominally:<br><br>Linear 1 V/div 3.3 V<br>2 V/div 3.3 V<br>5 V/div 6.7 V |

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 1 MHz to 500 MHz<br>Output level : -40 dBm to +10 dBm | Marconi 2019A |
| Oscilloscope | Frequency range: d.c. to 100 MHz | Tektronix 2235 |

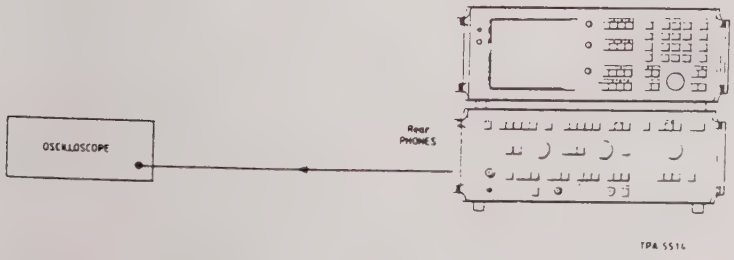


Fig. 33 Demodulated output test set-up.

Procedure

(1) Lock the analyzer and the generator to an external standard. Connect the rear PHONES output to the oscilloscope.

On the generator select:

| | |
|---|---|
| Carrier frequency | 100 MHz |
| AM depth | 30 % |
| Modulation frequency | 1 kHz |
| Modulation | Off |
| Output level | -10 dBm |

On the analyzer select:

| | |
|---|---|
| REF FREQ | 100 MHz |
| SPAN/DIV | 20 kHz |
| VOLTS/DIV | 100 mV full-scale |
| VOL control | fully clockwise |

(2) Adjust the r.f. level of the generator until the response is at 50 mV. Then switch the modulation on.

(3) On the analyzer select:

| | |
|---|---|
| ZERO SPAN | |
| RESOLUTION BANDWIDTH | 10 kHz |
| AUDIO (2ND FUNCT METER) | On |
| SWEEP TIME | 1 ms/div |

(4) The demodulated signal will be displayed on the oscilloscope. Check that its amplitude is approximately 2 V peak-to-peak.

# Chapter 5-2

## ADJUSTMENT AND CALIBRATION

CONTENTS

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- Procedures -

4 AA3 - 502.6 MHz band-pass filter
6 AA3a - 3rd mixer
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10 AA6b - Cavity oscillator p.c.b.
12 AA9/1 - 550 MHz v.c.o
14 AB1 - D to A converter
16 AB2 - Interpolation oscillator
18 AB3 - Master v.c.o
20 AB4 - Sampling gate
22 AB5 - Slave v.c.o
24 AB8 - Attenuator control
26 AC1 - 50 MHz crystal oscillator
28 AC2 - 47.4 MHz i.f. amplifier
30 AC3 - 2.6 MHz LC filter
32 AC4 - 100 kHz i.f. crystal filter
34 AC5 - 2.6 MHz crystal filter
36 AD1 - Log amplifier
38 AD4 - 10 MHz standard
40 AE1 - 50 MHz calibrator
42 AH2 - Input filter and 1st mixer
44 AH12 - Receiver p.s.u. distribution
46 AK14 - TG supply distribution
48 AJ6/1 - YTO driver
49 AR2 - Power supply interface

Table Page

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## INTRODUCTION

1. This chapter describes adjustments which will restore the analyzer to its peak operating condition. Test equipment recommended for this purpose is listed in Chap. 5-0 and summarized for each test board procedure. Before carrying out any adjustment procedures refer to Chap. 5-0 for safety considerations and access instructions.

2. Adjustable procedures are described for each board and are listed in board alpha-numeric order. When it is known that re-adjustment is needed on just one or two boards it is normally sufficient to confine activities to those boards alone. If extensive re-adjustment or re-calibration is needed, the complete set of procedures should be carried out, in the order shown in Table 1.

3. Adjustment and factory selected components are indicated on the circuit diagrams and their locations are shown on the layout diagrams opposite the circuit diagrams.

TABLE 1 BOARD CALIBRATION ORDER

| SEQUENCE | BOARD | TITLE |
|---|---|---|
| 1 | AR2 | Power supply interface |
| 2 | AD4 | 10 MHz standard |
| 3 | AC1 | 50 MHz crystal oscillator |
| 4 | AE1 | 50 MHz Calibrator |
| 5 | AB1 | D to A converter |
| 6 | AB2 | Interpolation oscillator |
| 7 | AB3 | Master v.c.o. |
| 8 | AB4 | Sampling gate |
| 9 | AB5 | Slave v.c.o. |
| 10 | AA5 | Translation oscillator |
| 11 | AA6b | Cavity oscillator p.c.b. |
| 12 | AJ6/1 | YTO driver |
| 13 | AH2 | Input filter and lst mixer |
| 14 | AB8 | Attenuator control |
| 15 | AA3 | 502.6 MHz band-pass filter |
| 16 | AA3a | 3rd mixer |
| 17 | AH12 | Receiver p.s.u. distribution |
| 18 | AC2 | 47.4 MHz i.f. amplifier |
| 19 | AK14 | TG supply distribution |
| 20 | AC3 | 2.6 MHz LC filter |
| 21 | AC5 | 2.6 MHz crystal filter |
| 22 | AC4 | 100 kHz i.f. crystal filter |
| 23 | AD1 | Log amplifier |

PROCEDURES

**AA3 - 502.6 MHz BAND-PASS FILTER** Circuit diagram: Chap. 7, Fig. 2

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer | Frequency range: 100 Hz to 4.2 GHz<br>Tracking generator facility | Marconi 2383 |

Initial conditions

4. (1) Select:

REF FREQ ..... 47.4 MHz
HORIZONTAL ..... ZERO SPAN
RF ATTEN ..... 0 dB

(2) Connect the 47.4 MHz OUTPUT on the rear panel to the test analyzer input. Connect the test analyzer tracking generator output to the INPUT socket of the 2383.

(3) On the test analyzer select:

Reference frequency ..... 47.4 MHz
Horizontal scale ..... 5 MHz/div
Vertical scale..... 10 dB/div
Reference level..... +5 dBm
Tracking generator ..... On

Setting up

5. (4) Adjust C1,C2,C3 and C4 for best shape and maximum signal on the test analyzer.

**AA3a - 3RD MIXER** Circuit diagram: Chap. 7, Fig. 2

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer | Frequency range: 100 Hz to 4.2 GHz<br>Tracking generator facility | Marconi 2383 |

Initial conditions

6. (1) Set up as for AA3.

Setting up

7. (2) Adjust C8 and C21 for maximum signal on the test analyzer.

## AA5 - TRANSLATION OSCILLATOR

Circuit diagram: Chap. 7, Fig. 4

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Counter | Frequency range : 600 MHz | Marconi 2440 |

Initial conditions

8. (1) Select:

PRESET

(2) Move SKD from PLD to PLJ on AA7.

(3) Remove board coupler to AA4 and connect the counter in its place.

Setting up

9. (3) Adjust R6 for 555.5 MHz ±0.5 MHz.

(4) Reconnect SKD to PLD on AA7.

## AA6b - CAVITY OSCILLATOR PCB

Circuit diagram: Chap. 7, Fig. 4

| TEST EQUIPMENT | | |
|---|---|---|
| Digital voltmeter | Function : d.c. volts | Solatron 7150 |

Initial conditions

10. (1) Select:

PRESET
SPAN/DIV..... 500 kHz
Enter 2383 diagnostic mode (see Chap. 5-3, para. x)
Select Monitor synth oscs
Select Cav
HORIZONTAL ..... /DIV

Setting up

11. (2) Connect DVM to TP8 on AA8.

(3) Check for +50 V w.r.t. ground.

(4) Adjust tuning stub, accessible through hole in side panel, for 551 MHz ±0.5 MHz.

(5) Exit from Monitor synth oscs back to main 2383 diagnostic menu.

(6) Enter Eeprom cal data access mode
Enter Oscillator cal mode
Calibrate Cavity osc
Exit from diagnostics

**AA9/1 - 550 MHz VCO** Circuit diagram: Chap. 7, Fig. 9

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Oscilloscope | Frequency range: d.c. to 100 MHz | Tektronix 2235 |

Initial conditions

12. (1) On the oscilloscope select:

Vertical mode ..... CH1
CH1 input coupling ..... DC
CH1 volts/div ..... 0.5 V/cm
Sweep time ..... 100 ms/cm
Trigger mode ..... Auto

(2) Set the oscilloscope CH1 to 0 V on centre horizontal graticule line.

(3) Connect the probe to TP6 on AA10/1.

Setting up

13. (4) Adjust R6 and record the maximum and minimum d.c. voltage levels that can be obtained before lock is broken (i.e. no search signal present on the oscilloscope display).

(5) Reset R6 for mid-point.

(6) Remove the probe.

## AB1 - D TO A CONVERTER

Circuit diagram: Chap. 7, Fig. 12

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Oscilloscope | Frequency range: d.c. to 100 MHz | Tektronix 2235 |

14. (1) Oscilloscope CH1.

0 V centre horizontal graticule line.
200 mV/div (x10 probe).
DC coupled.
Connect via a compensated x10 probe to TP24 (beat note).

Oscilloscope CH2.

0 V centre horizontal graticule line.
10 V/div (x10 probe).
DC coupled.
Connect via a x10 compensated probe to TP28 (search oscillator).

Oscilloscope timebase.

Vertical mode CH1 and CH2.
Trigger mode CH2, Internal, Auto, d.c.
Time/div 20 ms.

Initial conditions

(2) Select:

PRESET
SPAN/DIV ..... 100 MHz

Setting up

15. (3) Switch SA 206/1, /2, /3, /4, /5, /6, /7 to OPEN position.

(4) Enter 2383 diagnostics.
Enter Monitor synth oscs.
Select C[000]

This enables manual front panel control of the reference frequency drive to the YTO oscillator.

(5) If search waveform is present on CH2 go to (7).

(6) Ajust R21 on AJ6/1 until search oscillator starts.

Note: The overall d.c. level at TP24 should be 0V for correct operation of the search oscillator.

(7) Select Normal trigger from CH2 on the oscilloscope.
Select vertical mode CH1 only.

(8) Remove the pipe interconnection between the AJ1 and AK6 blocks.
Connect the C input of the 2440 counter to the output of AJ1.

(9) Using the rotary REF LEVEL control SLOWLY increase the coarse reference frequency D to A coverter (Ref dac) up until the counter reads 4.4 GHz. Record the value of the coarse D to A (N1).
Continue to adjust the reference D to A until the counter reads 9.1 GHz. Again record the value of the D to A (N2).

(10) Remove the 2440 counter and replace the interconnecting pipe between AJ1 and AK6.

(11) Using the rotary REF LEVEL reset the Ref dac to N1 and then slowly increase to N2 observing the beat note amplitude and the maximum and minimum d.c. levels on TP24 (CH1 on the oscilloscope).

(12) Reset R21 (AJ6/1) to give a mean 0V level, R84 to give a minimum beat note amplitude of 440 mV p-p over the coarse D to A range N1 to N2.

(13) Exit from diagnostics.
Switch SA 206/1, /2, /3, /4, /5, /6, /7 to CLOSED position.

## AB2 - INTERPOLATION OSCILLATOR

Circuit diagram: Chap. 7, Fig. 17

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Digital voltmeter | Function: d.c. volts | Solartron 7150 |

Initial conditions

16. (1) Select:

PRESET
SPAN/DIV ..... 2 kHz
Enter 2383 diagnostic menu
Enter Monitor synth oscs
Enter Ref dac C[255]

Setting up

17. (2) Observing the 2380 display tune T1 for 32.85 MHz or minimum frequency, whichever is the greater.

(3) Connect the DVM positive lead to PLN pin 5 and the negative lead to ground. Adjust REF LEVEL rotary control until a reading of +3 V is obtained.

(4) Check that the frequency displayed on the screen is greater than 28 MHz.

(5) Disconnect the DVM.

(6) Exit to main 2383 diagnostics [lower unit] menu
Enter Eeprom cal data access
Enter Oscillator cal
Enter Interp osc

(7) After a successful oscillator calibration exit from diagnostics.

**AB3 - MASTER VCO** Circuit diagram: Chap. 7, Fig. 18

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Digital voltmeter | Function: d.c. volts | Solartron 7150 |

Initial conditions

18. (1) Select:

PRESET
SPAN ..... 200 kHz/DIV
Enter 2383 diagnostic mode
Enter Monitor synth oscs
Enter Ref dac C[255]

Setting up

19. (2) Tune T1 for 34.35 MHz or minimum frequency, whichever is the greater.

(3) Connect the DVM positive lead to PLX pin 4 and the negative lead to ground. Adjust the rotary REF LEVEL control until a reading of +3 V is obtained.

(4) Check that the frequency displayed on the screen is greater than 26.25 MHz.

(5) Disconnect the DVM.

(6) Exit to main 2383 diagnostics [lower unit] menu
Enter Eeprom cal data access
Enter Oscillator cal
Enter LF Master

(6) After a successful oscillator calibration exit from diagnostics.

## AB4 - SAMPLING GATE

Circuit diagram: Chap. 7, Fig. 18

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Digital voltmeter<br>Counter | Function: d.c. volts<br>Frequency range: 30 kHz to 4.2 GHz | Solartron 7150<br>Marconi 2440 |

20. (1) Select:

PRESET
SPAN/DIV ..... 500 kHz

(2) Disconnect SKY from AB3.

(3) Connect the DVM positive lead to TP9 and negative lead to ground.

Setting up

21. (4) Adjust R21 for 0 V ±20 mV on TP9.

(5) Disconnect the DVM.

(6) Reconnect PLY.

(7) Select:

REF FREQ ..... 100 MHz
SPAN/DIV ..... 2 kHz
INC FREQ ..... 200 kHz

(8) Connect the counter to AB3 TP3.

(9) Increment the reference frequency by use of the REF FREQ ↓↑ keys and check that AB3 locks to 100 kHz steps between 28.000 MHz and 32.900 MHz.

(10) Disconnect the counter.

## AB5 - SLAVE VCO

Circuit diagram: Chap. 7, Fig. 19

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Oscilloscope<br>Digital voltmeter | Frequency range: d.c. to 100 MHz<br>Function : d.c. volts | Tektronix 2235<br>Solartron 7150 |

Initial conditions

22. (1) Oscilloscope CH1.

0 V centre horizontal graticule line.
2 V/div (x10 probe).
DC coupled.
Connect via a compensated x10 probe to junction R5/R58 AB3.

Oscilloscope CH2.

0 V centre horizontal graticule line.
2 V/div (x10 probe).
DC coupled.
Connect via a x10 compensated probe to TP5 AB3.
Inverted.

Oscilloscope timebase.

Vertical mode ADD, BOTH.
Trigger mode EXT, NORM, d.c., + slope.
Trigger oscilloscope from AD38 TP3 (sweep trigger) via a compensated x10 probe.
Time/div 20 ms.

(2) Select:

PRESET
SPAN/DIV ..... 200 kHz

23. Setting up

(3) Adjust L1 AB5 to centre waveform around 0 V as displayed on the oscilloscope.

(4) Remove all probes.

## AB8 - ATTENUATOR CONTROL

Circuit diagram: Chap. 7, Fig. 20

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Oscilloscope<br>Generator<br>RF amplifier | Frequency range: d.c. to 100 MHz<br>Frequency range: 1 MHz to 1 GHz<br>Frequency range: 1 MHz to 1 GHz<br>Gain: 40 dB | Tektronix 2235<br>Marconi 2019A<br>Marconi 2177 |

Initial conditions

24. (1) Select:

PRESET
CAL
RF ATTEN ..... 60 dB
REF LEVEL ..... +30 dBm
REF FREQ ..... 50 MHz
SPAN/DIV ..... 200 kHz
RESOLUTION BANDWIDTH ..... 30 kHz
VERTICAL dB/DIVISION ..... 5 dB/div

(2) Set the signal source for an output of 50 MHz at -40 dBm.

(3) Connect the signal source via the RF amplifier to the analyzer input.

(4) Disable the overload protection by selecting 2ND FUNCT : RF ATTEN ↑.

Setting up.

Note: Exercise extreme caution when increasing the signal source level to prevent damage to the input mixer. Under no circumstances should a level greater than +26.5 dBm be applied.

25. (5) Adjust the output of the signal source for a +26.5 dBm signal level on the screen.

(6) Link PLTJ/1 to PLTJ/3.

(7) Adjust R19 until D8 just lights.

(8) Link PLTJ/1 to PLTJ/4.

(9) Adjust R15 until D8 just lights.

(10) Link PLTJ/1 to PLTJ/2.

(11) Remove the input signal.

(12) Select PRESET to reset the overload input protection.

## AC1 - 50 MHz CRYSTAL OSCILLATOR

Circuit diagram: Chap. 7, Fig. 22

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Oscilloscope | Frequency range: d.c. to 100 MHz | Tektronix 2235 |

Initial conditions

26. (1) Set the oscilloscope to 0.05 µs/cm, auto trigger.

(2) Set the oscilloscope CH1 to 0.5 V/cm (x10 probe), a.c. coupled, 0 V centre horizontal graticule line.

(3) Connect CH1 input to TP2 via the x10 probe.

Setting up

27. (4) Adjust L2 for maximum signal level.

(5) Set CH1 to 200 mV/div and connect the probe to AC6 TP4.

(6) Adjust L3 for 0 V on the oscilloscope.

## AC2 - 47.4 MHz IF AMPLIFIER

Circuit diagram: Chap. 7, Fig. 23

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer<br>Active probe | Frequency range: 100 Hz to 100 MHz<br>Frequency range: 100 kHz to 1 GHz | Marconi 2370<br>Marconi 2388 |

Initial conditions

28. (1) Select:

PRESET
REF FREQ ..... 47.4 MHz
HORIZONTAL ..... ZERO SPAN

(2) On the test analyzer select:

Reference frequency ..... 47.4 MHz
Horizontal scale ..... 1 MHz/div
Vertical scale ..... 1 dB/div
Tracking generator ..... On
Reference level ..... -20 dBm

(3) Set the probe to 0 dB attenuation.

(4) Connect the probe to the test analyzer input.

(5) Connect the test analyzer tracking generator output to PLA using a suitable adapter.

(6) Connect the probe tip to TP1. (Ground the probe to the filter case).

Setting up

29. (7) Screw C9, C11, C13 fully in and C15 fully out.

(8) Tune C9 for a peak at 47.4 MHz on TP1.

(9) Tune C11 for a notch at 47.4 MHz on TP1.

(10) Tune C13 for a peak at 47.4 MHz on TP1.

(11) On the test analyzer change to:

Vertical scale ..... 10 dB/div
Reference level ..... 0 dBm

(12) Connect the probe to TP3.

(13) Tune C15 for a symmetrical response 20 dB down.

(14) On the test analyzer change to:

Reference frequency ..... 52.6 MHz

(15) Connect the probe to TP1.

(16) Adjust C4 for a notch at 52.6 MHz.

(17) Adjust R21 to maximize the notch at 52.6 MHz.

(18) Disconnect the probe.

**AC3 - 2.6 MHz LC FILTER** Circuit diagram: Chap. 7, Fig. 24

| TEST EQUIPMENT |
|---|
| - None required - |

Initial conditions

30. (1) Switch the SUPPLY off and back ON (this sets the i.f. and filter tune lines to their preset values).

(2) Select:

PRESET
REF FREQ ..... 50 MHz
RESOLUTION BANDWIDTH ..... 10 kHz
HORIZONTAL ..... ZERO SPAN
VERTICAL A B SELECT ..... A
VERTICAL dB/DIVISION ..... 1 dB
VERTICAL A B SELECT ..... B
VERTICAL dB/DIVISION ..... 1 dB
B VIEW ..... On

(3) Connect STD 50 MHz OUTPUT to INPUT.

(4) Remove power from the board by disconnecting PLH, then desolder the link between TP9 and TP10, and reconnect PLH.

(5) Link TP10 to TP3 with a shorting link.

(6) Select B SAVE (stores level on B trace).

(7) Link TP10 to TP4 with a shorting link.

Setting up

31. (8) Adjust C12 for a peak display and equalize the level with R39.

(9) Link TP10 to TP5 with a shorting link.

(10 Adjust C22 for a peak display.

(11) Link TP10 to TP6 with a shorting link.

(12) Adjust C32 for a peak display and equalize the level with R79.

(13) Link TP10 to TP7 with a shorting link.

(14) Adjust C42 for a peak display.

(15) Link TP10 to TP8 with a shorting link

(16) Adjust C52 for a peak display and equalize the level with R119.

(17) Disconnect PLH, remove the shorting link and resolder the original link between TP9 and TP10.

(18) Reconnect PLH.

## AC4 - 100 kHz IF CRYSTAL FILTER

Circuit diagram: Chap. 7, Fig. 26

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Frequency standard | Accuracy: 1 part in $10^6$ | |

Initial conditions

32. (1) Switch SUPPLY off and back ON (this sets the i.f. gain and filter tune lines to their preset values).

(2) Select:

PRESET
REF LEVEL ..... -5 dBm
REF FREQ ..... 50 MHz
SPAN/DIV ..... 10 Hz
VERTICAL A B SELECT ..... A
VERTICAL dB/DIVISION ..... 0.5 dB
TRACK GEN ..... On
RESOLUTION BANDWIDTH ..... 3 Hz

(3) Connect the external standard to EXT STD on the rear panel.

(4) Connect TRACKING GENERATOR to INPUT.

Setting up

33. (5) Set R30,R39,R59,R79 and R99 fully clockwise.

(6) Tune C23,C43,C63,C83 and C103 for maximum level.

(7) Select:

SPAN/DIV ..... 100 Hz
VERTICAL dB/DIV ..... 10 dB
RESOLUTION BANDWIDTH ..... 30 Hz

(8) Connect STD 50 MHz OUTPUT to INPUT.

(9) Disconnect the power from the board by removing PLX. Desolder link between TP11 and TP12. Replace PLX.

(10) Link TP12 and TP4 with a shorting link.

(11) Adjust R25 for symmetry.

(12) Change to:

SPAN/DIV ..... 20 Hz
VERTICAL dB/DIVISION ..... 1 dB

(13) Adjust C32 to centre the response on the dotted vertical reference line.

(14) Link TP2 to TP3 with a 100 nF capacitor.

(15) Link TP12 to TP6 with a shorting link.

(16) Change to:

SPAN/DIV ..... 100 Hz
VERTICAL dB/DIVISION ..... 10 dB

(17) Adjust R45 for skirt symmetry.

(18) Change to:

SPAN/DIV ..... 20 Hz
VERTICAL dB/DIVISION ..... 1 dB

(19) Adjust C52 to centre the response on the dotted vertical reference line.

(20) Link TP2 to TP5 with the 100 nF capacitor.

(21 Link TP12 to TP8 with a shorting link.

(22) Change to:

SPAN/DIV ..... 100 Hz
VERTICAL dB/DIVISION ..... 10 dB

(23) Adjust R65 for skirt symmetry.

(24) Change to:

SPAN/DIV ..... 20 Hz
VERTICAL dB/DIVISION ..... 1 dB

(25) Adjust C72 to centre the response on the dotted vertical reference line.

(26) Link TP2 to TP7 with the 100 nF capacitor.

(27) Link TP12 to TP10 with a shorting link.

(28) Change to:

SPAN/DIV ..... 100 Hz
VERTICAL dB/DIVISION ..... 10 dB

(29) Adjust R85 for skirt symmetry.

(30) Change to:

SPAN/DIV ..... 20 Hz
VERTICAL dB/DIVISION ..... 1 dB

(31) Adjust C92 to centre the response on the dotted vertical reference line.

(32) Link TP2 to TP9 with the 100 nF capacitor.

(33) Link TP12 to TP11 with a shorting link.

(34) Change to:

SPAN/DIV ..... 100 Hz
VERTICAL dB/DIVISION ..... 10 dB

(35) Adjust R105 for skirt symmetry.

(36) Change:

SPAN/DIV ..... 20 Hz
VERTICAL dB/DIVISION ..... 1 dB

(37) Adjust C112 to centre the response on the dotted vertical reference line.

(38) Remove the 100 nF capacitor and link. Remove PLX. Replace soldered wire link between TP11 and TP12. Replace PLX.

(39) Change to:

SPAN/DIV ..... 10 Hz
RESOLUTION BANDWIDTH ..... 1 MHz
B VIEW ..... On
VERTICAL A B SELECT ..... B
VERTICAL dB/DIVISION ..... 1 dB
TRACK GEN ..... On

(40) Connect TRACKING GENERATOR to INPUT.

(41) Press B SAVE (Stores reference level in B store).

(42) Change to:

RESOLUTION BANDWIDTH ..... 3 Hz.

(43) Adjust R13 to equalize the level with that of the stored trace.

(44) Change to:

RESOLUTION BANDWIDTH ..... 30 Hz

(45) Adjust R17 to equalize the level with that of the stored trace.

(46) Change to:

RESOLUTION BANDWIDTH ..... 10 Hz

(47) Adjust R15 to equalize the level with that of the stored trace.

## AC5 - 2.6 MHz CRYSTAL FILTER

Circuit diagram : Chap. 7, Fig. 28

| TEST EQUIPMENT |
|---|
| - None required - |

Initial conditions

34. (1) Switch SUPPLY off and back ON (this sets i.f. gain and filter tune lines to their preset voltages).

(2) Select:

PRESET
REF LEVEL ..... -5 dBm
REF FREQ ..... 50 MHz
SPAN/DIV ..... 100 Hz
RESOLUTION BANDWIDTH ..... 100 Hz
VERTICAL dB/DIVISION ..... 0.5 dB
TRACK GEN

(3) Connect TRACKING GENERATOR to INPUT.

Setting up

35. (4) Set R27, R43, R59, R74 and R82 fully clockwise.

(5) Tune C12,C22,C33,C42 and C53 for maximum display value.

(6) Remove power from the board by disconnecting PLL, then unsolder the link from between TP11 and TP12 and reconnect PLL.

(7) Connect STD 50 MHz OUTPUT to INPUT.

(8) Change to:

SPAN/DIV ..... 20 kHz
RESOLUTION BANDWIDTH ..... 3 kHz (not AUTO)
B VIEW ..... On
VERTICAL A B SELECT ..... B
VERTICAL dB/DIVISION ..... 10 dB
MARKERS A B SELECT ..... B
PEAK FIND
MKR1 SETS REF LEVEL

(9) Connect the shorting link between TP4 and TP12.

(10) Tune C9 for skirt symmetry.

(11) Change to:

SPAN/DIV ..... 2 kHz

(12) Tune L2 for centre frequency (note that the response will dip at the centre frequency).

(13) Refit the link to connect TP12 and TP6.

(14) Change to:

SPAN/DIV ..... 10 kHz
PEAK FIND
MKR1 SETS REF LEVEL

(15) Tune C20 for skirt symmetry.

(16) Change to:

SPAN/DIV ..... 1 kHz

(17) Tune L3 for centre frequency.

(18) Refit the link to connect TP12 to TP8.

(19) Change to:

SPAN/DIV ..... 10 kHz
PEAK FIND
MKR1 SETS REF LEVEL

(20) Tune C31 for skirt symmetry.

(21) Change to:

SPAN/DIV ..... 1 kHz

(22) Tune L4 for centre response.

(23) Refit the link to connect TP12 to TP10.

(24) Change to:

SPAN/DIV ..... 5 kHz
PEAK FIND
MKR1 SETS REF LEVEL

(25) Tune C40 for skirt symmetry.

(26) Change to:

SPAN/DIV ..... 1 kHz

(27) Tune L5 for centre response.

(28) Remove PLL and resolder the link between TP12 and TP11. Reconnect PLL.

(29) Change to:

SPAN/DIV ..... 5 kHz
PEAK FIND
MKR1 SETS REF LEVEL

(30) Tune C51 for skirt symmetry.

(31) Change to:

SPAN/DIV ..... 1 kHz

(32) Tune L6 for centre response.

(33) Connect TRACKING GENERATOR to INPUT.

(34) Change to:

VERTICAL A B SELECT ..... B
VERTICAL dB/DIVISION ..... 0.5 dB
RESOLUTION BANDWIDTH ..... 1 MHz
TRACK GEN ..... On
REF LEVEL ..... -5 dB
B SAVE ..... On
RESOLUTION BANDWIDTH ..... 300 Hz

(35) Adjust R11 to equalize the level with the stored trace.

(36) Change to:

RESOLUTION BANDWIDTH ..... 100 Hz

(37) Adjust R7 to equalize the level with the stored trace.

## AD1 - LOG AMPLIFIER

Circuit diagram: Chap. 7, Fig. 32

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Signal generator | Frequency range: 1 MHz to 1 GHz | Marconi 2019A |
| RF amplifier | Frequency range: 1 MHz to 1 GHz | Marconi 2177 |
| Digital voltmeter | Function: d.c. volts | Solartron 7150 |
| Precision attenuator pads | 10, 20, 20, 30 dB (with correction figures at 50 MHz) | Texscan FP-50 series |

Initial conditions

36. (1) Select:

PRESET
REF FREQ ..... 50 MHz
SPAN/DIV ..... 100 kHz
VERTICAL VOLTS/DIV ..... 1 V full-scale
MKR1 ..... On

Setting up

37. (2) Set R207 to mid-position.

(3) Remove SKX and terminate input pin PLX with a 50 ohm termination.

(4) Adjust R202 until the marker reads between 0.000 V and 0.005 V. (Note that when correctly set the marker reading will change between values within this range).

(5) Connect a 2.6 MHz +16 dBm signal to PLX via a 50 ohm feedthrough termination.

(6) Connect the DVM positive lead to PLAK, negative to ground. Adjust the signal generator output amplitude until the DVM reads +4.00 V.

(7) Connect the DVM positive lead to PLU. Adjust R20 for a DVM reading of +3.62 V.

(8) Change to:

PRESET
REF FREQ ..... 50 MHz
SPAN/DIV ..... 100 kHz
RESOLUTION BANDWIDTH ..... 1 MHz
PEAK FIND

(9) Carefully adjust the signal generator output to give a screen reading of 0.00 dBm.

(10) Reduce the signal level by 20.00 dB using the precision attenuator. Record the marker level readout.

(11) Remove the 20.00 dB attenuator and reconnect the signal generator directly. DO NOT READJUST THE OUTPUT LEVEL.

(12) Adjust R155 (G4 attenuator) until the screen reads exactly 20.00 dB above that recorded in (11) above, i.e. if reading in (11) above = -20.17 dBm then adjust R155 for -0.17 dBm.

(15) Carefully adjust the signal generator output to give a screen reading of 0.00 dBm.

(16) Reduce the signal level by 30.00 dB using the precision attenuators. Record the marker level readout.

(17) Remove the 30.00 dB of attenuation and reconnect the signal generator directly. DO NOT READJUST THE OUTPUT LEVEL.

(18) Adjust R39 (G1 attenuator) until the screen reads exactly 20.00 dB above that recorded in (15) above, i.e. if reading in (15) above = -29.92 dBm then adjust R39 for +0.08 dBm.

(19) Carefully adjust the signal generator output to give a screen reading of 0.00 dBm.

(20) Reduce the signal level by 60.00 dB using the precision attenuators. Record the marker level readout.

(21) Remove the 60.00 dB of attenuation and reconnect the signal generator directly. DO NOT READJUST THE OUTPUT LEVEL.

(22) Adjust R77 (G2 attenuator) until the screen reads exactly 60.00 dB above that recorded in (11) above, i.e. if reading in (11) above = -60.17 dBm then adjust R77 for -0.17 dBm.

(23) Carefully adjust the signal generator output to give a screen reading of 0.00 dBm.

(24) Reduce the signal level by 80.00 dB using the precision attenuators.

(25) Select:

A VIDEO AVG ..... 8 sweeps

On completion of the averaging record the marker level readout.

(26) Remove the 80.00 dB of attenuation and reconnect the signal generator directly. DO NOT READJUST THE OUTPUT LEVEL. Switch off the video averaging.

(27) Adjust R115 (G3 attenuator) until the screen reads exactly 80.00 dB above that recorded in (11) above, i.e. if reading in (11) above = -79.87 dBm then adjust R115 for -0.13 dBm.

(28) Remove all test connectors and replace board interconnecting leads.

(29) Connect STD 50 MHz OUTPUT to the INPUT socket.

(30) Select:

PRESET
REF FREQ ..... 50 MHz
SPAN/DIV ..... 200 kHz
RESOLUTION BANDWIDTH ..... 1 MHz
RF ATTEN ..... 20 dB
VERTICAL ..... VOLTS/DIV
VERTICAL SCALE ..... 10 mV/DIV
PEAK FIND

(31) Record the marker level readout.

(32) Shift down one range to 5 mV/DIV.

(33) Adjust R164 for same marker reading as noted in (31) above.

## AD4 - 10 MHz STANDARD

Circuit diagram: Chap. 7, Fig. 38

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Frequency counter | To measure 10 MHz with an accuracy of ±1 part in $10^6$. | Marconi 2440 with ext. freq. standard. |

Initial conditions

38. (1) After switching on allow 15 minutes for the TCXO to reach thermal equilibrium.

(2) Turn the back panel SET INT STD control fully anticlockwise into the detent.

(3) Connect the frequency counter to the STD 50 MHz OUTPUT socket.

Setting up

39. (4) Adjust R1 to obtain a reading of 50.000000 MHz.

## AE1 - 50 MHz CALIBRATOR

Circuit diagram: Chap. 7, Fig. 44

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Generator | Frequency range: 1 MHz to 1 GHz | Marconi 2019A |

Initial conditions

40. (1) Set the signal source to give an output of 50 MHz, -10 dBm ±0.01 dB.

(2) Connect the signal source to the INPUT socket.

(3) Select:

PRESET
REF FREQ ..... 50 MHz
SPAN/DIV ..... 100 kHz
B VIEW ..... On
A SAVE ..... On

Setting up

41. (4) Enter 2383 diagnostic [lower unit]
Enter System cal tests
Enter View internal signals
Enter Internal 50 MHz STD [on]

(5) Select:

PEAK FIND

and record marker reading.

(6) Select:

MARKER A B SELECT..... B
PEAK FIND

(7) Adjust R20 to give marker reading as noted in (5) above.

(8) Enter Internal 50 MHz [off]
Exit from diagnostics

(9) Connect front panel STD 50 MHz OUTPUT to INPUT socket.

(10) Select:

PEAK FIND

(11) Adjust R40 to give marker reading as noted in (5) above.

## AH2 - INPUT FILTER AND 1st MIXER

Circuit diagram: Chap. 7, Fig. 51

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer | frequency range: 1 GHz to 12 GHz | Anritsu MS710C |

Initial conditions

42. (1) Select:

PRESET
REF FREQ ..... 0 MHz
SPAN/DIV ..... 500 kHz
RF ATTEN ..... 10 dB
RESOLUTION BANDWIDTH ..... 1 MHz

(2) Enter 2383 diagnostics [lower unit]
Enter System cal tests
Enter Set dc marker nulling dacs
Enter Pin (coarse) [128]
Enter Varactor (fine) [128]

**Note:** Exercise extreme caution when adjusting the JOHANNSON TUNING SCREWS.
SCREWING THESE IN TOO FAR WILL DAMAGE THE SUBSTRATE IRRECOVABLY.

Setting up

43. (3) Set R97 (AH12) fully clockwise.

(4) Carefully adjust the DC MARKER ADJUST for a minimum level on the screen.

(5) Adjust R96 (AH12) for a minimum level.

(6) Repeat (3) & (4) above until the displayed response is below -40 dBm.

(7) Exit from diagnostics.

(8) Select:

PRESET
REF FREQ ..... 0 MHz
RF ATTEN ..... 0 dB
HORIZONTAL ..... ZERO SPAN

(9) Connect the test analyzer input to the 2383 input socket.

(10) On the test analyzer select:

Frequency band ..... 1.7 GHz to 23 GHz
Reference frequency ..... 4.9026 GHz
Span/division ..... 200 kHz
Reference level ..... -40 dBm
Vertical dB/div ..... 10 dB

(11) Tune L.P. FILTER ADJUST for minimum signal level shown on the test analyzer

**AH12 - RECEIVER PSU DISTRIBUTION** Circuit diagram: Chap. 7, Fig. 57

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Spectrum analyzer | Frequency range: 100 Hz to 4.2 GHz | Marconi 2383 |

Initial conditions

44. (1) Select:

PRESET
REF FREQ ..... 50 MHz
RF ATTEN ..... 0 dB
HORIZONTAL ..... ZERO SPAN

(2) On the test analyzer select:

Reference frequency ..... 47.4 MHz
Top of screen ..... +5 dBm
Horizontal scale ..... 1 MHz/div
Vertical scale ..... 10 dB/div
Tracking generator ..... On

Setting up

45. (3) Connect the STD 50 MHz -10 dBm signal from the front panel to the 2383 input socket.

(4) Adjust R98 (AH12) to give a displayed response on the test analyzer of 2 dB greater than the test analyzer tracking generator output level.

## AK14 - TG SUPPLY DISTRIBUTION

Circuit diagram: Chap. 7, Fig. 75

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| - None - | | |

Initial conditions

46. (1) Select:

PRESET
TRACK GEN ..... On
TRACK GEN LEVEL ..... -15 dBm

47. Setting up

(2) Connect the Tracking generator to the analyzer input socket.

(3) Press NORMALIZE

(4) Change to:

TRACK GEN LEVEL ..... -9.7 dBm

(5) Check displayed trace for flatness. Adjust R127 if necessary.

(6) Change to:

TRACK GEN LEVEL ..... -20.3 dBm

(7) Again check for a flat display. Readjust R127 if necessary.

(8) Repeat (4) to (7) until both conditions are met.

## AJ6/1 - YTO DRIVER

Circuit diagram: Chap. 7, Fig. 62

48. (1) The adjustments for AJ6/1 are included with the AB1 setting up procedure.

## AR2 - POWER SUPPLY INTERFACE

Circuit diagram: Chap. 7, Fig. 81

| TEST EQUIPMENT | | |
|---|---|---|
| Description | Minimum specification | Example |
| Digital Voltmeter | Function: d.c. Volts | Solartron 7150 |

49. (1) Connect the positive lead of the DVM to TP3, negative to ground. Adjust R25 for +15V ±0.05V.

(2) Connect the positive lead of the DVM to TP4. Adjust R27 for -5.5V ±0.05V.

(3) Connect the positive lead of the DVM to TP6. Adjust R26 for -15V ±0.05V.

# Chapter 5-3

## FAULT DIAGNOSIS

CONTENTS

Para.

1 Introduction
2 Operation
2 Access to diagnostic functions
3 Operating the menus
7 Menu descriptions
8 System cal tests
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21 Non-volatile cal data access
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Appendix

A Instrument CAL functions
B Synthesizer parameter description
C Oscillator calibration
D Instrument trace numbers
E 2383 Error numbers

## INTRODUCTION

1. As an aid to fault finding and factory calibration, the 2383 spectrum analyzer has a number of programmed diagnostic functions which are menu driven and accessible from the front panel. This document describes the use and operation of these functions.

## OPERATION

### Access to diagnostic functions

2. Access to diagnostic functions is as follows:

> Select and hold INTMD IDENT key down and use SET TG key to enter level of 23.83 dB.

This will display a letter **D** (for diagnostics) in the top right corner of the screen and also display the following message on the screen:

> **Use 2nd FUNCT AUTO RF ATTEN to access lower unit diagnostics**

Selecting 2nd FUNCT and then AUTO RF ATTEN key will allow access to lower unit diagnostic functions and display the top level menu.

### Operating the menus

3. Having gained access to the diagnostic functions, the following keys and shaft encoder (rotary control) are redefined to allow operation of the menus:

RF ATTEN dec key
RF ATTEN auto key
RF ATTEN inc key
REF LEVEL rotary control

#### RF ATTEN inc key and RF ATTEN dec key

4. These keys move the cursor from function to function (or field to field) in the menus. These keys are also used to modify the status or data in any field enclosed in brackets, **[]**.

#### RF ATTEN auto key

5. This key is used to select a function or a field specified by the position of the cursor. If menu selection is a function, then the next menu associated with the function is displayed on the screen. Exit takes you to the previous menu. If menu selection is a field, then the status or data in this field will be displayed in inverse video and may be modified by using the RF ATTEN ↓↑ keys. The selected function may be deselected by pressing the key again.

> Note...
> There are exceptions where the data or the status in the selected field is returned by the instrument and not available for modification by the RF ATTEN ↓↑ keys.

While in menu operation, selecting 2nd FUNCT and then AUTO RF ATTEN key will allow quick exit from any level of menu operation.

#### REF LEVEL rotary control

6. A complementary control to the RF ATTEN ↓↑ keys. Its definition is the same as for the RF ATTEN ↓↑ keys.

## MENU DESCRIPTIONS

7. Having gained access to the diagnostic functions, the following menu will be displayed on the screen:

```
2383 diagnostics [lower unit]

>    Exit
     System cal tests
     Synth activities
     Monitor synth sweep
     Monitor synth oscs
     Eeprom cal data access
     I/O Port operations
     PLL Margin tests
     Exit 2383 diagnostics

Use RF ATTEN group and REF LEVEL encoder
```

Any one of the functions listed on the menu may be selected by moving the cursor using the RF ATTEN ↓↑ keys or REF LEVEL rotary control to the desired function and selecting the function by using the RF ATTEN auto key. This will select the next menu associated with the function.

### System cal tests

8. This function gives access to some of the parameters associated with the instrument CAL key. When selected, the following menu is displayed on the screen. It allows different aspects of the CAL routine to be examined manually. For a detailed description of the instrument CAL function, refer to Appendix A.

```
System cal tests

>    Exit
     View internal signals
     Set TG level dac
     Set IF filter tune dacs
     Set dc marker nulling dacs
     Full system calibration

Use RF ATTEN group and REF LEVEL encoder
```

### View internal signals

9. Selecting this function will display the following menu on the screen:

```
View internal signals

>    Exit
     Internal cal signal          [off]
     Internal 50Mhz STD           [off]

Use RF ATTEN group and REF LEVEL encoder
```

Selecting this function allows the input to the attenuator to be selected between either the signal from the tracking generator calibrator output or the internal 50 MHz STD instead of the front panel INPUT socket. The status of the function is displayed in the respective field.

**Set TG level dac**

10. Selecting this function will display the following menu on the screen:

**Set TG level dac**

> **Exit**
**TG level dac** **[128]**

**Use RF ATTEN group and REF LEVEL encoder**

Use of this function allows the value of the TG level dac (address 76Q) on AB1 board to be modified whilst viewing the tracking generator output. Under normal operation this value is set during instrument CALibration.

**Set IF filter tune dacs**

11. Selecting this function will display the following menu on the screen:

**Set IF filter tune dac**

> **Exit**
**Filter freq dac (swept)** **[128]**
**Filter level dac (swept)** **[128]**
**Filter freq dac**
**Filter level dac**

**Use RF ATTEN group and REF LEVEL encoder**

This function allows the i.f. filter characteristics to be set up manually by addressing the respective dacs on AB1 board (address 73Q filter, address 74Q gain).

(a) **Filter freq and level dacs (swept)**

Selecting this function will allow the 1 kHz and 3 kHz filters to be tuned while the system is being swept. Tune the filter so that it is symmetrical about the centre graticule line and at -10 dB.

Prior to entering this mode the system should have been set up as follows:

| | |
|---|---|
| RF ATTEN | 10 dB |
| REF LEVEL | 0 dB |
| dB/DIVISION | 2 dB |
| CENTRE REF FREQ | 50 MHz |
| RESOLUTION BANDWIDTH | Filter under test |
| SPAN/DIV | Nearest span to ten times filter bandwidth under test |
| INPUT | From STD 50 MHz output |

(b) **Filter freq and level dacs**

Selecting this function will allow all filters except the 1 kHz and 3 kHz filters to be tuned. Entering this mode will display the relevant data and a meter marker on the screen.

To tune the freq dac, vary the signal level count for a maximum value.

To set the signal path gain (i.e. level dac) vary the level dac until the signal level count reads 3704. This will give a meter display of -15 dBm. Note that a change of 1 count, to 3705, represents an increase in level of 0.025 dB. In this mode a -10 dB calibration signal is internally fed through the signal path and its level is measured and displayed on the screen.

NOTE: Any deviation from above figures will render the instrument out of CAL. To exit from above function press PRESET.

**Set dc marker nulling dacs**

12. Selecting this function will display the following menu on the screen:

```
Set dc marker nulling dacs

>   Exit
    Pin (coarse)                [128]
    Varactor (fine)             [128]

Use RF ATTEN group and REF LEVEL encoder
```

This function allows the dc marker to be nulled assuming it is displayed on the screen. The "Pin diode" (dac address 145Q AB1 board) provides a coarse adjustment and the "Varactor diode" (dac address 146Q AB1 board) provides a fine adjustment. For a successful absolute null, select each function in turn and vary the respective dac for a minimum dc marker.

**Full system calibration**

13. This function allows the instrument to be calibrated while in diagnostics. The Freq Measure Delay function may be used to slow down the calibration function and allow the cal figures to be observed. Also while nulling the dc marker all diode values are displayed rather than just the absolute minimum. At the end of the cal function use PRESET to get back to the menu.

## Synth activities

14. This menu allows the synthesizer setting up sequence to be monitored. It also allows various delays to be introduced into the system in order to slow down the setting up of the system. For a description of the synthesizer setting up sequence, refer to Appendix B.

**Synth activities**

| | | |
|---|---|---|
| > | **Exit** | |
| | **Freq measure delay** | [010] |
| | **Flyback delay** | [050] |
| | **Monitor synth set up** | [off] |
| | **Synth trace numbers** | [on ] |

**Use RF ATTEN group and REF LEVEL encoder**

Any one of the functions above may be selected by moving the cursor to the desired function and modifying the respective data or status in that field. The function becomes active at the end of the select operation.

### Freq measure delay

15. This function introduces a delay to the measurement of any oscillator. The data in the respective field is in milliseconds.

### Fly back delay

16. This function introduces a delay to the time between each sweep. The data in the respective field is in milliseconds. This function may be used to confirm that the left-hand sweep frequency is correct prior to the sweep starting. Selecting TRACK GEN, having connected its output to the counter, will confirm that the left-hand frequency is stable and correct.

### Monitor synth set up

17. This function sets the condition for the synthesizer parameters to be monitored whilst the synthesizer is setting up. It becomes active when not in diagnostic menu operation. Note that it may be desirable to slow the synthesizer setting up procedure which may be achieved by introducing some Freq Measure Delay as described above.

### Synth trace numbers

18. This function allows the synthesizer activity to be monitored while the system is running. The activity is represented by two character columns of numbers between 00 and 99, displayed to the right of the screen. For number (i.e. activity) definition refer to Appendix D.

Monitor synth sweep

19. Selecting this function will display the following menu on the screen:

```
Monitor synth sweep

>   Exit
    Int        28,665,840Hz      28,665,840Hz
   *Lfm        30,404,192Hz      30,403,712Hz
    Cav                0Hz              0Hz
    Yto    4,902,600,000Hz   4,902,875,136Hz
    FL         29,904,192Hz
    FC         30,404,192Hz
    FR         30,904,192Hz     N[18]   M[11]

    Ref dac        C[117]     M[238]   F[138]
    Sw dac       Swp[2343]    S[024]   G[198]
    Swp calc       SL2343     SC1217   SR0000

Use RF ATTEN group and REF LEVEL encoder
```

Parameters associated with the synthesizer are displayed on the screen while in this menu. All the frequencies in the left column are calculated figures while all the ones on the right are measured. The system will function normally in all respects and allow the following parameters to be modified under normal sweep conditions:

(i) N value (AA8 board)
(ii) M value (AA8 board)
(iii) Ref dac value (AB1 board)
(iv) Step dac (S) value (AB1 board)
(v) Gain dac (G) value (AB1 board)

This allows the sweep waveform characteristics and swept oscillator frequency to be observed whilst the system is sweeping. Sweep oscillator is shown by "*" on the menu. Note that the cavity (Cav) oscillator is represented here but does not form part of the menu functions. See Appendix B for a detailed description of above parameters.

## Monitor synth oscillators

20. Selecting this function will display the following menu on the screen:

**Monitor synth sweep**

| | | | | |
|---|---|---|---|---|
| > | Exit | | | |
| | Int | 28,665,840Hz | 28,665,840Hz | |
| | *Lfm | 30,404,192Hz | 30,403,712Hz | |
| | Cav | 0Hz | 0Hz | |
| | Yto | 4,902,600,000Hz | 4,902,875,136Hz | |
| | FL | 29,904,192Hz | | |
| | FC | 30,404,192Hz | GP[15.625 mS] | |
| | FR | 30,904,192Hz | N[18] | M[11] |
| | Ref dac | C[117] | M[238] | F[138] |
| | Sw dac | Swp[2343] | S[024] | G[198] |
| | Swp calc | SL2343 | SC1217 | SR0000 |

**Use RF ATTEN group and REF LEVEL encoder**

This function is very similar to Monitor Synth Sweep described previously, except that it allows the selected oscillator frequency to be monitored continuously rather like a counter. The following parameters may be modified while in this function.

(i) N value
(ii) M value
(iii) **Ref dac** value (only on swept oscillator)
(iv) Gate period (GP), (AD38 board)

This allows the oscillator frequency range to be checked on the swept oscillator using a different gate period. Note that SPAN/DIV may have to be changed to monitor the desired oscillator frequency range. Sweep oscillator is shown by **"*"** on the menu. Note that the cavity (Cav) oscillator is represented here but does not form part of the menu functions. See Appendix B for a detailed description of the above parameters.

## Non-volatile cal data access

21. In order for the instrument to function within specification, the system oscillators have to be calibrated and the calibration data stored in the non-volatile memory. This is as a result of the non-linear characteristics of the oscillators. Note that this only needs to be done at first power up and subsequent software version changes. This function allows various parameters associated with the oscillator calibration to be interrogated and in some cases modified. It is important to note that since all calibration data is stored in non-volatile memory, unauthorized operation of these functions may result in void instrument specification, even after power down. All valid fields must either read **[Calibrated]** or **[ on]** for optimum instrument operation.

```
Non volatile cal data access

>    Exit
     Sweep gain
     Linearisation
     Oscillator cal
     Tracking generator cal

WARNING: Unauthorized operation of above
functions may result in void Inst spec.

Use RF ATTEN group and REF LEVEL encoder
```

Sweep gain

22. When selected, the following menu will be displayed on the screen:

```
Sweep gain

>    Exit
     Interp    osc          [on ]
     Lf master osc          [on ]
     Cavity    osc          [off]
     Yig tuned osc          [on ]

WARNING: Unauthorized operation of above
functions may result in void Inst spec.

Use RF ATTEN group and REF LEVEL encoder
```

Any one of the oscillators (not cavity osc) above may be selected by moving the cursor to the desired function and modifying the respective status in that field. When enabled this function changes the value of the sweep gain dac (address 75Q) on AB1 board and in so doing sets the span to within 2% of its specified value.

A one bit change on the dac is equivalent to 0.5% change on the span (i.e. reducing the value to 195 from a nominal of 200 will reduce the span by 2.5%). In cases where adjustment in excess of 15% is attempted, an error "46" is flagged up and the dac set back to its nominal value of 200.

It is possible to monitor this condition by enabling Synth Trace Numbers as described above.

Linearisation

23. When selected, the following menu will be displayed on the screen:

```
Linearisation

>    Exit
     Interp    osc          [on ]
     Lf master osc          [on ]
     Cavity    osc          [off]
     Yig tuned osc          [off]

WARNING: Unauthorized operation of above
functions may result in void Inst spec.
```

**Use RF ATTEN group and REF LEVEL encoder**

Any one of the oscillators (not cavity or yig tuned osc) above may be selected by moving the cursor to the desired function and modifying the respective status in that field. When enabled, in order to get a linear sweep from the swept oscillator, the voltage ramp applied to the oscillator is made up of small segments, and the slope of each segment is determined from the non-linear characteristics (cal data) of the oscillator.

## Oscillator cal

24. This function allows each of the oscillators to be calibrated individually or in succession and returns the calibration status in the respective field at the end of the process. During calibration the PRESET key may be used to abort the operation. Also, detailed inspection of the process is possible by introducing some Freq Measure Delay prior to entering this function. A summary of oscillator calibration is give in appendix D.

Oscillator cal is accessed through the following menu:

**Oscillator cal**

```
>   Exit
    Interp    osc        [ Calibrated ]
    Lf master osc        [ Calibrated ]
    Cavity    osc        [Uncalibrated]
    Yig tuned osc        [ Calibrated ]
    YTO cal with eeprom data
    ALL osc cal
```

**WARNING: Unauthorized operation of above functions may result in void Inst spec.**

**Use RF ATTEN group and REF LEVEL encoder**

Note Sweep Gain and Linearisation functions are only available for modification if the oscillators are calibrated. Again, the cavity oscillator is represented here but does not form part of the available functions.

## Tracking generator cal

25. The purpose of this calibration is to load into non-volatile memory the tracking generator DAC settings which give all the levels between and including -9.7 dB to -20.3 dB in 0.1 dB steps. The following menu is displayed when this function is selected:

**Tracking generator cal**

```
>   Exit
    Tracking generator       [ Calibrated ]
    TG level dac                      [128]
```

**WARNING: Unauthorized operation of above functions may result in void Inst spec.**

**Use RF ATTEN group and REF LEVEL encoder**

In addition to the calibration function, the value of TG level dac may be varied using the Set TG Level Dac procedure. Note, it is essential that an instrument cal (i.e. CAL key) is carried out before and after the Tracking Generator is calibrated.

I/O Port operations

26. Selecting this function will display the following menu on the screen:

```
I/O Port operations

>   Exit
    Port number        Oct[071]
    Port data          Dec[015]  Bin[00001111]
    Single write to port           [off]
    Continuous write to port       [on ]
    Single read from port          [off]

Use RF ATTEN group and REF LEVEL encoder
```

This function allows a byte value to be written to or read from any port in the lower unit. To address a particular port move the cursor to "Port number" and modify the respective data in that field to the desired port number. Now move the cursor to the function "Port data" and modify the data in the field to the desired value. To execute a single write to the selected port, move the cursor to the function "Single write to port" and select this function, which will address the specified port with the data. To continuously address a particular port, select "Continuous write to port" and set the status to "on". Now select the function "Port data" and modify the data as desired.

To read a particular port, specify the desired port number as described above and then select "Single read from port". This will address the respective port and display the value in the "Port data" field.

PLL Margin tests

27. The purpose of the margin tests is to test the instrument or some part of the region beyond the range encountered in normal operation, to establish that some margin of safety exits in the design.

Historically, phase-locked loops have caused trouble. Some phase-locked loops have the unfortunate attribute that the feedback loop can be broken, and lock regained, even though there is no component fault. In order for the loop to function without breaking lock, the following conditions must be satisfied:

(a) The controlled oscillator must cover the required frequency range.

(b) The loop must have an adequate voltage range to control the oscillotor over this range.

(c) The loop must have adequate bandwidth to remain in lock.

Selecting this function allows all three conditions to be tested beyond the normal operating range by sweeping the loop over an extended frequency range in the normal time. When selected, the following menu is displayed on the screen.

**PLL Margin tests**

**> Exit**
**Margin test 1**
**Margin test 2**

**Use RF ATTEN group and REF LEVEL encoder**

Margin test 1

28. Selecting this function doubles the sweep voltage to the LF master VCO (approximately doubling its sweep range). The LF master will then be swept over twice its normal range. By performing this sweep with the dc marker on the screen, the following loops are checked merely by observing on the screen that the signal remains at a fixed postion.

Loops tested: LF slave,
translation,
cavity,
YTO.

Margin test 2

29. The only loop not tested beyond normal range by this single test is the LF master loop which when required, locks at multiples of 100 kHz. The test phase locks the LF master VCO and applies a sweep voltage to its sweep input. The interpolation is set to display dc marker on the screen. This level should not change as the LF master loop survives the disturbance caused by the sweep (i.e. the sweep voltage should not knock the loop out of lock). The sweep voltage applied to the LF master VCO may be varied by changing span.

Exit 2383 diagnostics

30. This function stops further access to the diagnostic operation and removes the letter D from the top right corner of the screen.

## ERROR NUMBERS

31. Whilst in diagnostic mode, the error messages are displayed in the following format:

Error <unit> <number> <address> <error message>

e.g. Error T4 20BF 0038 Invalid operation

| | |
|---|---|
| unit | : B (error originated from lower unit)<br>T (error originated from upper unit |
| number | : error code (01 to 99) |
| address | : address at which error was detected (base offset) |
| error message | : corresponding message to error code in the range 01 to 39. |

Note...
When not in diagnostic mode, if codes 1 to 39 are generated, the corresponding message (see Appendix D) in the table is flagged. Error codes greater than 39 are generated as "Synthesizer error".

# APPENDIX A

## Instrument CAL functions

1. Under normal operation, the spectrum analyzer CAL function is executed in order to set the gain of the signal path. The signal path is defined as the route that a signal takes in passing from the INPUT socket to the 2380 display. At a single frequency the gain of the signal path will depend on the following: the insertion loss and tuning of the resolution bandwidth filters; the gain of a series of amplifiers; the insertion loss of the input attenuators and the conversion loss of a number of mixers. Most of these parameters, as well as varying with age and temperature, vary with frequency.

2. A signal displayed at a level of -10 dB should remain so irrespective of the RF ATTEN setting. If, for example, the RF ATTEN is increased by 20 dB the signal path gain is maintained constant by increasing the i.f. gain by 20 dB. Some RESOLUTION BANDWIDTH filters introduce two more mixers into the signal path, others have different tuning characteristics and all have a different insertion loss. The input attenuator (RF ATTEN), input amplifier, input filter and input mixer are all frequency dependent so changes to the SPAN/DIV or REF FREQ will have different effects on the signal path gain at different frequencies. Changes to RF ATTEN, RESOLUTION BANDWIDTH or SPAN/DIV will require a new set of gain correction figures. These figures are derived during the CAL operation.

3. There are three resolution filter groups: the 100 kHz i.f. (3 Hz to 30 Hz) crystal filter bank; the 2.6 MHz i.f. (100 Hz to 3 kHz) filter bank and the 2.6 MHz i.f (10 kHz to 1 MHz) LC filter bank. Each group has varactor tuning and is adjusted from the d.c. output of an 8-bit DAC. The 100 kHz filter bank is connected to the tuning voltage at all times whilst the 2.6 MHz i.f groups are only controlled when selected. During calibration, each group is peaked for a maximum signal on the 50 MHz calibration signal. Only the narrowest filter in each group is adjusted (i.e. 3 Hz, 100 Hz and 10 kHz filters) since the wider bandwidth filters are automatically corrected by this adjustment.

4. Both crystal filter groups have the shunt stray capacitance of the bandwidth determining resistor neutralized by an inductor to avoid filter detuning at wide bandwidths when the damping resistor has a high value. On the 2.6 MHz filter bank, the temperature coefficient of the coil needs to be neutralized by adjustment of the bias to a varactor in shunt with the coil. Since the effect is only significant on the 3 kHz filter, the same tuning DAC is used as LC detuning effects on this filter are negligible. This "Null Strays" compensation is also applied to the 1 kHz filter since the damping resistor detuning effect is just visible on this filter. The value applied to this filter is 7 bits less than that applied to the 3 kHz filter to allow for small changes in circuit capacitance due to the reconfiguration of the f.e.t switching.

5. Single frequency gain compensation is made by writing the gain correction figures into a DAC to generate a voltage which then controls the gain of an i.f. amplifier by means of a pin diode. Gain compensation at different frequencies is achieved by software scaling the displayed data as it is transferred from the input store of the display unit to the display store and then the screen. The software scaling algorithm uses the data obtained during the decade section of the calibration routine.

## APPENDIX B

### Synthesizer parameter description

1. In essence, the synthesizer consists of four oscillators:

| | | |
|---|---|---|
| 1) | Interpolation oscillator | (Int or osc 0) |
| 2) | Lf master oscillator | (Lfm or osc 1) |
| 3) | Cavity oscillator | (Cav or osc 2) |
| 4) | Yig tuned oscillator | (Yto or osc 3) |

Given the instrument SPAN/DIV and REF FREQ, all oscillator frequencies can be calculated.

#### TF2383 100 Hz - 4.2 GHz

Fout = 275N - 10M + 2Flfm + Fint/16
= 275N - 10M + 2F1 + F0/16

Where:
Fout is the final synthesizer output frequency
N and M are the programmable divider factors on AA8 board
Nmax = 34
Nmin = 16
Mmax = 37
Mmin = 10

Note, N is also the yig harmonic number.
Also:
M = 5m (10-37)
m = M/5 (2-7.4)

Following are the parameters associated with the oscillators:

#### Interpolation oscillator (osc 0)

F0max = 35 MHz
F0min = 28 MHz
F0mid = F0max/2 + F0min/2
= 31 000 000 Hz
F0park = 28.8 MHz
S0min = 100 Hz (where S is system Span)
S0max = 20 KHz

**Lf master oscillator (osc 1)**

F1max = 34.1 MHz
F1min = 26.0 MHz
F0laim = 67 068 750 Hz
S1min = 50 KHz
s1max = 2 Mhz

**Yig tuned oscillator (osc 3)**

F3max = 9.1026 GHz
F3min = 4.9026 GHz
S3min = 5 MHz
S3max = 4200 MHz

2. Given the span and the reference frequency, the software determines which oscillator needs to be swept and calculates the centre frequencies. It then derives the left (FL), centre (FC) and right (FR) hand frequencies for the swept oscillator and then sets up the swept oscillator on FL. Other oscillators are set up to give the correct sweep. For synthesizer sweep details, see Table 1.

TABLE 1 SYNTHESIZER SWEEP DETAILS

| Sweep Span | Sweep span code | Atten | Interp | Lf | YTO | |
|---|---|---|---|---|---|---|
| | | | | | FM | Main |
| Full Span | 28 | 0.96 | | | | |
| 4200 MHz | 27 | 0.96 | | | | |
| 4000 MHz | 26 | 1 | Park | Phase | GND | Sweep |
| 2000 MHz | 25 | 2 | 28.8MHz | locked | | & |
| 1000 MHz | 24 | 4 | | @ | | Ref |
| 500 MHz | 23 | 8 | | 30.5MHz | | |
| 200 MHz | 22 | 20 | | | | |
| 100 MHz | 21 | 40 | | | | |
| 50 MHz | 20 | 2 | Park | Phase | Sweep | Slug |
| 20 MHz | 19 | 5 | 28.8MHz | locked | | & |
| 10 MHz | 18 | 10 | | @ | | Ref |
| 5 MHz | 17 | 20 | | 30.5MHz | | |
| 2 MHz | 16 | 1 | Park | Sweep | Lock | Hold |
| 1 MHz | 15 | 2 | 28.8MHz | & | | in |
| 500 kHz | 14 | 4 | | Ref | | |
| 200 kHz | 13 | 10 | | | | |
| 100 kHz | 12 | 20 | | | | |
| 50 kHz | 11 | 40 | | | | |
| 20 kHz | 10 | 1x1 | Sweep | Phase | Lock | Hold |
| 10 kHz | 9 | 2x1 | & | locked | | in |
| 5 kHz | 8 | 4x1 | Ref | on | | |
| 2 kHz | 7 | 1x10 | | 100kHz | | |
| 1 kHz | 6 | 2x10 | | tooth | | |
| 500 Hz | 5 | 4x10 | | | | |
| 200 Hz | 4 | 10x10 | | | | |
| 100 Hz | 3 | 20x10 | | | | |

# APPENDIX C

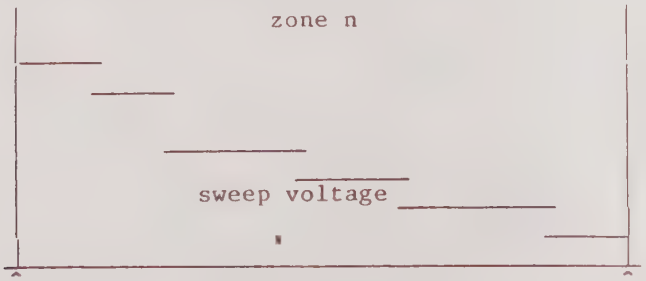
## Oscillator calibration

### LF master and Interpolation oscillator calibration

1. Due to the non-linear voltage/frequency characteristic of the oscillators, calibration of the LF master and Interpolation oscillators is necessary. This is in order for the system to set the oscillators to the desired frequency and generate a sweep. The data derived during calibration is stored in the non-volatile memory.

2. The non-linear characteristics of an oscillator is approximated by dividing its frequency range into a number of zones within which the oscillator is assumed to be linear. The zones are of fixed width (in frequency) and the sweep bits required to give this frequency for zone n are stored in a look-up table (referred to here as Z(n) bits).

Calibration zone n:




f right - f zone range
(from sweep dacs = z(n) bits)
with ref dac giving f right

f right
(from ref dac)
with sweep dac at
offset
(approx. zero)

3. The reference dacs are set to give the right-hand frequency (f right) with sweep dac at an offset (approx. 0 V). The sweep dacs are then adjusted to give the frequency shift equal to the zone range and stored in the non-volatile memory (i.e. f right - f zone range).

4. The right-hand frequency is now increased by zone range, and the ref dac adjusted to give the new right-hand frequency (with the sweep set to offset). The sweep dac is again adjusted to give the new zone range shift and the process is repeated until the end of the oscillator range.

The oscillators are calibrated with the following parameters:

| | Start freq | Zone range | End freq | Total zone |
|---|---|---|---|---|
| Osc0: | 26.9 MHz | 100 kHz | 34.1 Mhz | 72 |
| Osc1: | 28.432 MHz | 64 kHz | 32.4 MHz | 62 |

**YTO calibration**

5. For the yig to be set at the desired frequency (fyig), the calibration needs to determine the values for A and B where:

fyig = AX + B
X = refdac value
A = frequency/bit
B = yig freq at x = 0

6. With YTO addressed by ref dac (say x1) set to give high yig frequency (fyig1), at least two lock points are guaranteed by driving the cavity oscillator from top and bottem end of its range to give n0 and n1 where:

$$fyig1 = \frac{n0 * fcav0}{2} = \frac{n1 * fcav1}{2}$$

from which:

$$n0 * fcav0 = (n0 \pm a) * fcav1$$

where n1 = (n0 ± a)
a = number (1 or 2 max)

from which:

$$n0 = \frac{(\pm)a * fcav1}{(fcav0 - fcav1)}$$

hence:

fyig1 = (A * x1) + B .....(equ 1)

7. At low yig frequency, two such locking points are not guaranteed but by an iterative process it is possible to set the ref dacs such that two locking points occur. At this point a = 1 only, hence:

$$n0 = \frac{(\pm)fcav1}{(fcav0 - fcav1)}$$

from which:

fyig0 = (A * x0) + B .....(equ 2)

From equations 1 and 2, A and B can be determined:

A = (fyig1 - fyig0) / (x1 - x0)
and B = fyig0 - (A * x0)

Yig coefficients A and B are named a_yig_coefficent and b_yig_coefficient respectively.

Note that prior to the above yig calibration the cavity oscillator is calibrated in similar fashion to the lf master and interpolation oscillator cal. This is to allow the cavity oscillator to be pretuned befor allowing it to lock to the desired yig harmonic in order for the yig count to be derived.

For **fyig = ax + b**, typical cal figures are given:

| | | |
|---|---|---|
| **a.....** | = | 26,931,873 Hz |
| **b on main coil.....** | = | 3,542,146,863 Hz |
| **b on fm coil.....** | = | 3,552,324,048 Hz |
| **f/bit on main coil...** | = | 709,885 Hz |
| **f/bit om fm coil.....** | = | 15,449 Hz |

The f/bit value refers to the sweep dac, and is also derived during yig calibration. Above figures may be accessed by selecting:

**YTO cal with eeprom data.**

## APPENDIX D

### Instrument trace numbers

1. The following trace numbers will be displayed at the appropriate time on the screen when this function is enabled as previously described in Synth Trace Numbers:-

| Trace number | Activity description |
|---|---|
| | (10*(osc number) + number of measurements) First column indicates the oscillator number and second column indicates the number of measurements |
| 01-09 | Interpolation oscillator (osc 0) |
| 10-19 | Lf master oscillator (osc 1) |
| 20-29 | Cavity oscillator (osc 2) |
| 30-39 | Yig tuned oscillator (osc 3) |
| 30- | YTO measured in Synthesized mode (measured but not corrected). |
| 40 + i | Where i is the number of attempts at successfully locking the cavity to the yig in order to derive a count for the yig. |
| 50 | 50 followed by two digit number xx, where xx is a factor determining the YTO settling time i.e. yig settling time = (xx * 10) ms. |
| 70 | Interpolation update: If the lf master oscillator is being swept then the interpolation oscillator is parked at its free running frequency. To compensate for any drift on the interpolation oscillator, an update is carried out every 1 minute when the oscillator is measured and the synthesizer reset. |
| 71 | Tea time: This is carried out every 10 sec when the swept oscillator is reset. This is to correct for any drift on the sweep. |
| 80 | Sweep dac gain adjustment enabled. |
| 81 | Setting up of oscillator until completion of linearisation. |
| 82 | Sweep linearisation routine enabled. |
| 83 | Sweep attenuator adjustment at insensitive region of oscillator characteristic (sweep attenuator overide). |
| 86 | Failed to phase lock lf master. |
| 90 + i | Where i = 0 (missed correct lock where n = preset n), i = 1 (missed correct lock where n = preset n ± 1). |

# APPENDIX E

## 2383 error messages

1. Following is a list of all error numbers and corresponding messages for the 2383:-

| Error No | Error message description |
|---|---|
| 00 | Not used |
| 01 | Unrecognized header on inter-unit bus |
| 02 | Unrecognized key |
| 03 | Sweep out of range |
| 04 | Invalid operation |
| 05 | Options not installed |
| 06 | Do case over-run |
| 07 | Invalid store operation |
| 08 | Illegal DATA entry |
| 09 | DATA entry out of range |
| 10 | Divide error |
| 11 | Invalid sweep condition |
| 12 | Out of range |
| 13 | Control disabled |
| 14 | Failed on calibration |
| 15 | Noise in 1 Hz selected while on ZERO SPAN |
| 16 | No response from lower unit |
| 17 | Integer arithmetic overflow |
| 18 | GPIB: Undefined block data |
| 19 | Overheating |
| 20 | GPIB: Max line length exceeded |
| 21 | GPIB: Unrecognized header |
| 22 | GPIB: Unavailable item |
| 23 | GPIB: Invalid data field |
| 24 | GPIB: No listeners - output aborted |
| 25 | GPIB: Invalid checksum |
| 26 | GPIB: Incompatible binary data |
| 27 | GPIB: Too many mask limits |
| 28 | No tracking generator fitted |
| 29 | Fault during marker horizontal calculation |
| 30 | Lost Track |
| 31 | Write protected store NOT cleared |
| 32 | IB buffer full error |
| 33 | <10dB RF ATTEN not enabled |
| 34 | Input protection reduced |
| 35 | Array ´block data´ overflow (GPIB) |
| 36 | Attempt to read empty input buffer (GPIB) |
| 37 | Spare |
| 38 | GPIB output buffer overflow |
| 39 | Failed to write output data for GPIB when required |
| 40 | Failed to set reference on interp osc (osc 0) |
| 41 | Failed to set reference on 1f master (osc 1) |
| 42 | Failed to set reference on cavity osc (osc 2) |
| 43 | Failed to set reference on yig (osc 3) |

| Error No | Error message description |
|---|---|
| 44 | Spare |
| 45 | Lf master not phase locked |
| 46 | Sweep Gain DAC adjust range exceeded |
| 47 | YTO not locked to cavity in Synthesized mode (lock line-check on AJ6) |
| 48 | Non-volatile memory cleared |
| 49 | Interp or lf master osc out of range |
| 50 | Spare |
| 51 | Log amp sweep abort failure |
| 52 | Log amp sweep abort failure |
| 53 | Spare |
| 54 | Linearisation failure on interp or lf master oscillator sweep |
| 55 | Linearisation failure on cavity sweep |
| 56 | Sweep dac adjust range exceeded at low end (0 bits) |
| 57 | Sweep dac adjust range exceeded at high end (4905 bits) |
| 58 | Spare |
| 59 | Spare |
| 60 | Input protection on for attenuation less then 10 dB |
| 61 | Unable to level TG with 50 MHz level |
| 61 | Unable to null DC marker |
| 62 | -10 dB cal estimate not found on internal TG cal signal |
| 63-69 | Spare |
| 70 | Failed to cal zone on interpolation osc |
| 71 | Failed to cal zone on lf master osc |
| 72 | Failed to cal zone on cavity osc |
| 73-90 | Spare |
| 91 | During yig count "n" not an integer (i.e. cavity failed to lock to yig) |
| 92 | Failed to lock 5 times (i.e. 5 error 91) |
| 93 | Comparison between calculated "n" and derived "n" from cavity measure not valid in locked sweeps |
| 93 | During YTO CAL, failed ref cal |
| 94 | During YTO CAL, failed sweep cal |
| 95 | During cavity CAL, (data for setting cavity during yto count) cavity not within 514 to 550 MHz |
| 96 | Cavity failed to lock to YTO during YTO count (lock check line) |
| 97 | Yig cal points to derive yig law too close |
| 98-99 | Spare |

# Chapter 6

## REPLACEABLE PARTS

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| 3 | Component values | | |
| 4 | Manufacturer's part numbers | | |
| 6 | Ordering | | |
| 7 | Electrical components | | |
| 7 | Unit A0 | - 4.2 GHz Spectrum Analyzer RF unit | 52383-900G |
| 8 | Unit AA0/AB0 | - RF box assembly (AA/AB) | 44990-660V |
| 9 | Board AA2 | - 502.6 MHz amplifier | 44828-544A |
| 10 | Unit AA3 | - 502.6 MHz band-pass filter | 44990-441H |
| 11 | Board AA3a | - 3rd mixer | 44828-452L |
| 12 | Board AA4 | - 550 MHz buffer | 44828-526V |
| 13 | Board AA4a | - Translation loop mixer | 44829-141T |
| 14 | Board AA5 | - Translation oscillator | 44828-527S |
| 15 | Board AA6 | - Cavity oscillator buffer | 44828-528W |
| 16 | Unit AA6a/1 | - Cavity oscillator | 44990-809R |
| 17 | Board AA6b/1 | - Cavity oscillator PCB | 44829-506L |
| 18 | Board AA7 | - Translation loop | 44828-529D |
| 19 | Board AA8 | - Fractional division PLL | 44828-530S |
| 20 | Board AA9/1 | - 550 MHz VCO | 44828-546H |
| 21 | Board AA10/1 | - 550 MHz phase detector | 44829-493A |
| 22 | Board AA11 | - Line cleaner | 44828-533T |
| 23 | Board AA12 | - Divide by 16 | 44828-534P |
| 24 | Unit AB0 | - AB tray assembly | 44990-661S |
| 25 | Board AB1 | - D-A converter | 44828-547E |
| 26 | Board AB1/1 | - D-A converter | 44829-507J |
| 27 | Board AB2 | - Interpolation oscillator | 44828-537C |
| 28 | Board AB3 | - Master VCO | 44828-464P |
| 29 | Board AB4 | - Sampling gate | 44828-465X |
| 30 | Board AB5 | - Slave VCO | 44828-466M |
| 31 | Board AB6 | - Phase detector | 44828-467C |
| 32 | Board AB7 | - Oscillator select | 44828-538R |
| 33 | Board AB8 | - Attenuator control | 44828-543K |
| 34 | Unit AC0/AD0 | - IF box assembly (AC/AD) | 44990-663D |
| 35 | Board AC1 | - 50 MHz crystal oscillator | 44828-540C |
| 36 | Board AC2 | - 47.4 MHz IF amplifier | 44828-473K |
| 37 | Board AC3 | - 2.6 MHz LC filter | 44828-474A |
| 38 | Board AC4 | - 100 kHz IF crystal filter | 44828-475Z |
| 39 | Board AC5 | - 2.6 MHz crystal filter | 44828-476H |
| 40 | Board AC6 | - Phase detector | 44828-477E |
| 41 | Unit AD0 | - AD tray | 44990-664T |
| 42 | Board AD1 | - Log amplifier | 44828-479Y |
| 43 | Board AD2 | - Log amp interface | 44829-140D |
| 44 | Board AD4 | - 10 MHz standard | 44829-139P |
| 45 | Board AD38 | - Microprocessor | 44828-535X |
| 46 | Unit AE0 | - Microwave tray | 44990-665P |
| 47 | Board AE1 | - 50 MHz calibrator | 44828-548U |

CONTENTS (continued)


| Para. | | | | Unit |
|---|---|---|---|---|
| 48 | Unit AF0 | - | Front panel | 44990-669R |
| 49 | Board AF1 | - | Front panel keyboard | 44828-494D |
| 50 | Board AF2 | - | Front panel logic | 44828-495T |
| 51 | Unit AG1 | - | Input switch | 44338-120H |
| 52 | Unit AG2 | - | 4-section attenuator | 44429-031Y |
| 53 | Unit AG3 | - | Power protection pick-off assembly | 44990-672R |
| 54 | Unit AH0 | - | Receiver & 2nd LO assembly | 44990-666X |
| 55 | Unit AJ0 | - | 1st LO assembly | 44990-667M |
| 56 | Unit AK0 | - | Tracking generator assembly | 44990-668C |
| 57 | Unit AM0 | - | Basic module | 44990-707R |
| 58 | Unit AR0 | - | Rear panel | 44990-670M |
| 59 | Board AR1 | - | Signal interface | 44829-451P |
| 60 | Board AR2 | - | Power supply interface | 44828-541R |
| 61 | Unit AZ1 | - | Optical encoder | 44990-455W |
| 62 | Board AZ2 | - | Sweep span switch | 44828-498M |
| 63 | Miscellaneous mechanical parts | | | |

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| 1 | Miscellaneous mechanical parts ... ... ... ... ... | 169 |

## INTRODUCTION

1. Each sub-assembly or printed circuit board in this instrument has been allocated a unit identification, e.g. A0, AA2, AB1 etc. The complete component reference carries its unit number as a prefix e.g. AB3C3 (capacitor C3 on the master VCO board) but for convenience in the text and on circuit diagrams the prefix is not used. However, when ordering replacements or in correspondence the complete component reference must be quoted.

Note...

Units containing microwave components e.g. AH0, AJ0, are listed only to unit level in this manual. These components are listed in Chap. 6 of the Microwave Service Manual, H 52383-900G Vol. 2A, Part No. 46881-857Y, obtainable* from our Service Division (address at rear of manual) or your nearest agent.

## ABBREVIATIONS

2. The components are listed in alphanumerical order of the complete circuit reference and the following abbreviations are used :

| | | |
|---|---|---|
| C | : | capacitor |
| Carb | : | carbon |
| Cer | : | ceramic |
| D | : | semiconductor diode |
| Elec | : | electrolytic |
| FS | : | fuse |
| IC | : | integrated circuit (package) |
| L | : | inductor |
| LP | : | lamp |
| Max | : | maximum |
| ME | : | meter |
| Met | : | metal |
| Mic | : | mica |
| Min | : | minimum |
| Ox | : | oxide |
| PL | : | plug |
| Plas | : | plastic or |
| S | : | switch |
| SK | : | socket |
| T | : | transformer |
| Tant | : | tantalum |
| TP | : | terminal |
| TR | : | transistor |
| Var | : | variable |
| W | : | watts at $70^0$C |
| WW | : | wirewound |
| X | : | miscellaneous |
| XL | : | crystal |

* For release to microwave trained service engineers.

## COMPONENT VALUES

3. One or more of the components fitted in the equipment may differ from those listed in this chapter for any of the following reasons:

(a) Components indicated by an * have their values selected during test to achieve particular performance limits.

(b) Owing to supply difficulties, components of different value or type may be substituted provided the overall performance of the equipment is maintained.

(c) As part of a policy of continuous development, components may be changed in value or type to obtain detailed improvements in performance.

When there is a difference between the component fitted and the one listed, always use as a replacement the same type and value as found in the equipment.

## MANUFACTURERS' PART NUMBERS

4. To assist you in obtaining replacements, components are listed with both a Marconi Instruments (MI) part number and a manufacturer's part number. The manufacturer can be identified by the 5-character Mfr. code which is cross-referenced to the manufacturer's name and address at the end of the list.

5. Mfr. codes with four digits and a prefix letter are NSCM codes (Nato Supply Codes for Manufacturers). Those with five digits are FSCM codes (Federal Supply Codes for Manufacturers), which are assigned to North American suppliers.

## ORDERING

6. When ordering replacements, address the order to our Service Division (address at rear of manual) or nearest agent and specify the following for each component required:-

(1) Type# and serial number of equipment.
(2) Complete circuit reference.
(3) Description.
(4) Part number.

#As given on the serial number label at the rear of the instrument; if this is superseded by a model number label, quote the model number instead of the type number.

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **ELECTRICAL COMPONENTS** | | | | |
| **Unit A0** | **- 4.2 GHz Spectrum Analyzer RF Unit** | | | |
| 7. When ordering, prefix circuit reference with A0 | | | | |
| | Complete unit | 52383-900G | U2632 | 52383-900G |
| UT2 | EPROM Set (AD38 IC41-45) | 44533-206H | U2632 | 44533-206H |
| UT3 | EPROM Set (AD2 IC14,15) | 44533-151V | U2632 | 44533-151V |
| UT6 | Cable Assy | 43130-448M | U2632 | 43130-448M |
| UT7 | Cable Assy | 43130-520X | U2632 | 43130-520X |
| UT8 | Cable Assy | 43130-521M | U2632 | 43130-521M |
| UT9 | Cable Assy | 43130-664Z | U2632 | 43130-664Z |

Notes ...

(1) PROGRAMMED PROMS ARE LISTED UNDER BOARDS AD2 AND AD38.

(2) CABLE ASSEMBLIES NOT LISTED ABOVE CAN GENERALLY BE FOUND UNDER A RELEVANT BOX OR TRAY ASSEMBLY.

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AA0/AB0 - RF Box Assembly (AA/AB)** | | | | |
| 8. When ordering, prefix circuit reference with AA0/AB0 | | | | |
| | Complete unit | 44990-660V | U2632 | 44990-660V |
| C1 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C2 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C3 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C4 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C5 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C6 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C7 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C8 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C9 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C10 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C11 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C12 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C13 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C14 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C15 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C16 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C17 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C18 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C19 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C20 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C21 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C22 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C23 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C24 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C25 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C26 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C27 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C28 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C29 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C30 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C31 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C32 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C33 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C34 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C35 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C36 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C37 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AA0/AB0** | **- RF Box Assembly (AA/AB)** (Contd.) | | | |
| C38 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C39 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C40 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C41 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C42 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C43 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C44 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C45 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C46 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C47 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C49 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C50 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C51 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C52 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C53 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C54 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C55 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C56 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C57 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C58 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C59 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C60 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C61 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C62 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C63 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C64 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C65 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C66 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C67 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C68 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C69 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C70 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C71 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C72 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C73 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C74 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C75 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C76 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C77 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C78 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C79 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C80 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C81 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AA0/AB0** | **- RF Box Assembly (AA/AB)** | (Contd.) | | |
| C82 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C83 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C84 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C85 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C86 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C87 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C88 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C89 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C90 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C91 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C92 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C93 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C94 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C95 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C96 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C97 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C98 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C99 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C100 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C101 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C102 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C103 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C104 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C105 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C106 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C107 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C108 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C109 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C110 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C111 | CAP CER 50P 300V 10% | 26333-229U | K8445 | FT73 |
| C112 | CAP PETP 1UO 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C113 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C114 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| L1 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L2 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L4 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L5 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L6 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L7 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L8 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L9 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AA0/AB0** | **- RF Box Assembly (AA/AB)** | (Contd.) | | |
| L10 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L11 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L12 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L13 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L14 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L15 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L17 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L18 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L19 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L20 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L21 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L22 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L23 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L24 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L25 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L26 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L27 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L28 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L29 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L30 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L31 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L32 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L33 | IND | 34900-918Y | U2632 | 34900-918Y |
| L34 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L35 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L36 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L37 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L38 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L39 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L40 | IND CHOKE 1000UH 10% LAQ | 23642-567C | U4038 | SC10 49 |
| L41 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L43 | IND | 34900-918Y | U2632 | 34900-918Y |
| L44 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L45 | IND CHOKE 1000UH 10% LAQ | 23642-567C | U4038 | SC10 49 |
| L46 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L47 | IND CHOKE 1000UH 10% LAQ | 23642-567C | U4038 | SC10 49 |
| L48 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L49 | IND | 34900-918Y | U2632 | 34900-918Y |
| L50 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L51 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L54 | IND CHOKE .68UH 10% LAQ | 23642-548N | U4038 | SC10 11 |
| L55 | IND CHOKE .33UH 10% LAQ | 23642-546U | U4038 | SC10 07 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AA0/AB0** | **- RF Box Assembly (AA/AB)** | (Contd.) | | |
| MP94 | CON-PART MIN HOUSING 1ROW 2P | 23435-167C | | |
| MP95 | CON-PART MIN HOUSING 1ROW 5P | 23435-168R | | |
| MP96 | CON-PART MIN HOUSING 1ROW 11P | 23435-993R | | |
| MP97 | CON-PART MIN SKT 22-26AWG REEL | 23435-178U | U2338 | MINI PV 4756 |
| MP98 | CON-PART MIN HOUSING 1ROW 7P | 23435-179Y | | |
| MP99 | CON-PART MIN POLARIZING KEY | 23435-190G | | |
| MP100 | CON-PART MIN HOUSING 1ROW 4P | 23435-198M | | |
| MP101 | CON-PART MIN HOUSING 1ROW 3P | 23435-171R | U2338 | MINI PV65039-034 |
| MP102 | CON-PART MIN HOUSING 1ROW 10P | 23435-997Z | | |
| MP103 | CON-PART MIN HOUSING 1ROW 6P | 23435-992C | | |
| MP105 | CON-PART MIN HOUSING 1ROW 8P | 23435-999E | | |
| PLAE | CON-RF SMB-MALE 50RR BKHD ELB | 23444-351P | K1072 | GE65209MBN |
| PLAP | CON-RF SMB-MALE 50RR BKHD SOLD | 23444-331H | K1072 | GE65218BNMBN |
| PLAS | CON-RF SMB-MALE 50RR BKHD ELB | 23444-351P | K1072 | GE65209MBN |
| PLAT | CON-RF SMC-MALE 50RR BD EL BK | 23444-383P | | |
| PLAU | CON-RF SMB-MALE 50RR BKHD ELB | 23444-351P | K1072 | GE65209MBN |
| PLAV | CON-RF SMC-MALE 50RR BKHD S/TA | 23444-382T | K1072 | GE65318MBN |
| PLAW | CON-RF SMB-MALE 50RR BKHD ELB | 23444-351P | K1072 | GE65209MBN |
| R1 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| UT7 | COUPLER ASSY RF | 41700-379P | U2632 | 41700-379P |
| UT14 | Cable Assy | 43130-746G | U2632 | 43130-746G |
| UT15 | Cable Assy (16 Way Ribbon) | 43130-747V | U2632 | 43130-747V |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA2** | **- 502.6 MHz Amplifier** | | | |
| 9. When ordering, prefix circuit reference with AA2 | | | | |
| | Complete unit | 44828-544A | U2632 | 44828-544A |
| C12 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C13 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C14 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C15 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C16 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C17 | CAP CER 33P 63V 2% | 26343-471Y | K8996 | 2222 682 |
| L5 | COIL ASSEMBLY CHOKE UHF | 44190-033M | U2632 | 44190-033M |
| PLZ | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R13 | RES CC 130R .125W 5% | 24331-954W | U0914 | BB1315 |
| R14 | RES CC 22R .125W 5% | 24331-988T | U0914 | BB2205 |
| R15 | RES MF 1KO .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R16 | RES MF 2K7 .125W 2% 100PPM | 24772-083Z | U0142 | CMF51 |
| R17 | RES MF 120R .25W 2% 100PPM | 24773-251L | K8996 | MR25 |
| R18 | RES MG 13R .125W 2% 200PPM | 24321-728K | U0914 | BCD |
| TR5 | TR NSI BFR96S 15V 5G - AMP | 28452-172N | K8996 | BFR96S |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AA3** | **- 502.6 MHz Band-pass Filter** | | | | |
| 10. When ordering, prefix circuit reference with AA3 | | | | | |
| | Complete unit | | 44990-441H | U2632 | 44990-441H |
| C1 | CAP-VAR PLAS 2PO OP2 TRIM | | 26877-005A | K0066 | PTU/2/ST |
| C2 | CAP-VAR PLAS 2PO OP2 TRIM | | 26877-005A | K0066 | PTU/2/ST |
| C3 | CAP-VAR PLAS 2PO OP2 TRIM | | 26877-005A | K0066 | PTU/2/ST |
| C4 | CAP-VAR PLAS 2PO OP2 TRIM | | 26877-005A | K0066 | PTU/2/ST |
| D1 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| L1 | IND RF FILTER UHF | | 34900-923L | U2632 | 34900-923L |
| L2 | IND RF FILTER UHF | | 34900-924J | U2632 | 34900-924J |
| L3 | IND RF FILTER UHF | | 34900-924J | U2632 | 34900-924J |
| L4 | IND RF FILTER UHF | | 34900-923L | U2632 | 34900-923L |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AA3a** | **- 3rd Mixer** | | | | |
| 11. When ordering, prefix circuit reference with AA3A | | | | | |
| | Complete unit | | 44828-452L | U2632 | 44828-452L |
| C5 | CAP PETP 100N 63V 10% | | 26582-429F | K1945 | R68 D C 1003 AAK |
| C6 | CAP CER 1P8 63V .5PF | | 26343-456C | K8996 | 2222 682 |
| C7 | CAP CER 4P7 63V .5PF | | 26343-461B | K8996 | 2222 682 |
| C8 | CAP-VAR PLAS 5P5 1P4 TRIM | | 26878-405H | K8996 | 2222 808 11A558 |
| C9 | CAP CER 10N 25V 20% | | 26383-006C | K1439 | SDPN RF0605 |
| C10 | CAP TANT 4U7 35V 20% BEAD | | 26486-219P | U3613 | SH |
| C11 | CAP CER 10N 25V 20% | | 26383-006C | K1439 | SDPN RF0605 |
| C12 | CAP CER 2P7 63V .5PF | | 26343-458B | K8996 | 2222 682 |
| C13 | CAP CER 56P 63V 2% | | 26343-474J | K8996 | 2222 682 |
| C14 | CAP CER 5P6 63V .5PF | | 26343-462K | K8996 | 2222 682 |
| C15 | CAP PETP 100N 63V 10% | | 26582-429F | K1945 | R68 D C 1003 AAK |
| C16 | CAP CER 56P 63V 2% | | 26343-474J | K8996 | 2222 682 |
| C17 | CAP CER 39P 63V 5% | | 26343-472N | K8996 | 2222 682 |
| C18 | CAP CER 39P 63V 5% | | 26343-472N | K8996 | 2222 682 |
| C19 | CAP CER 56P 63V 2% | | 26343-474J | K8996 | 2222 682 |
| C20 | CAP PETP 100N 63V 10% | | 26582-429F | K1945 | R68 D C 1003 AAK |
| C21 | CAP CER 39P 63V 5% | | 26343-472N | K8996 | 2222 682 |
| C22 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C23 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C24 | CAP CER 22N 18V 20% | | 26383-007R | U4011 | ECK FIH223ZV |
| D2 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D3 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| L5 | IND CHOKE 1.0UH 10% LAQ | | 23642-549L | U4038 | SC10 13 |
| L6 | IND CHOKE 10UH 10% LAQ | | 23642-555G | U4038 | SC10 25 |
| L7 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L9 | INDUCTOR 30NH | | 34900-916E | U2632 | 34900-916E |
| L10 | INDUCTOR 30NH | | 34900-916E | U2632 | 34900-916E |
| L11 | INDUCTOR 20NH UHF | | 34900-915H | U2632 | 34900-915H |
| L12 | INDUCTOR CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L13 | INDUCTOR CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| R1 | RES MF 2K2 .125W 2% 100PPM | | 24772-081K | U0142 | CMF51 |
| R2 | RES MF 2K2 .125W 2% 100PPM | | 24772-081K | U0142 | CMF51 |
| R3 | RES MF 5K6 .125W 2% 100PPM | | 24772-091N | U0142 | CMF51 |
| R4 | RES MF 9K1 .125W 2% 100PPM | | 24772-096V | U0142 | CMF51 |
| R5 | RES MF 470R .125W 2% 100PPM | | 24772-065S | U0142 | CMF51 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA3a** | **- 3rd Mixer** | (Contd.) | | |
| R6 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R7 | RES MF 2K4 .125W 2% 100PPM | 24772-082A | U0142 | CMF51 |
| R8 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R9 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF515 |
| R10 | RES MF 1KO .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R11 | RES MF 390R .125W 2% 100PPM | 24772-063G | U0142 | CMF51 |
| R12 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R13 | RES MF 2K4 .125W 2% 100PPM | 24772-082A | U0142 | CMF51 |
| R14 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R15 | RES MF 1KO .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R16 | RES MF 390R .125W 2% 100PPM | 24772-063G | U0142 | CMF51 |
| R17 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R18 | RES MF 5K6 .25W 2% 100PPM | 24772-091N | U0142 | CMF51 |
| R19 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R20 | RES MF 1KO .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R21 | RES CC 220R .125W 5% | 24331-976N | U0914 | BB2215 |
| R22 | RES MF 2K4 .125W 2% 100PPM | 24772-082A | U0142 | CMF51 |
| TR1 | TR NMF BF960 20V 20MA - SOT103 ! | 28459-054R | K8996 | BF960 |
| TR2 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR3 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR4 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR5 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA4** | **- 550 MHz Buffer** | | | |
| 12. When ordering, prefix circuit reference with AA4 | | | | |
| | Complete unit | 44828-526V | U2632 | 44828-526V |
| C1 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C2 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C3 | CAP CER 4P7 63V .25P | 26343-461B | K8996 | 2222 682 |
| C4 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C5 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C6 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C7 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C8 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C9 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C10 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C11 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C12 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C13 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C14 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C15 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C16 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C17 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| L1 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L4 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L5 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L6 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L8 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L9 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L10 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R2 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R3 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R7 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R8 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R9 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R10 | RES MF 390R .125W 2% 100PPM | 24772-063G | U0142 | CMF51 |
| R11 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R12 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R13 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA4** | **- 550 MHz Buffer** | | (Contd.) | |
| R14 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R15 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R16 | RES CC 8R2 .125W 5% | 24331-941E | U0914 | BB82G5 |
| R17 | RES CC 8R2 .125W 5% | 24331-941E | U0914 | BB82G5 |
| R18 | RES CC 150R .125W 5% | 24331-990D | U0914 | BB1515 |
| R19 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R20 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R21 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R22 | RES MF 390R .125W 2% 100PPM | 24772-063G | U0142 | CMF51 |
| R23 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R24 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R25 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R26 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R27 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| TR1 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR2 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR3 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR4 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| T1 | TRIFILAR MATCHING TRANS | 43590-130R | U2632 | 43590-130R |
| T2 | BIFILAR OUTPUT TRANS | 43590-128B | U2632 | 43590-128B |
| X1 | FILTER BANDPASS 550MHZ HELICAL | 23642-940W | | |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA4a** | **- Translation Loop Mixer** | | | |
| 13. When ordering, prefix circuit reference with AA4A | | | | |
| | Complete unit | 44829-141T | U2632 | 44829-141T |
| C1 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C2 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C3 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C4 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C5 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C6 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C7 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C8 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C9 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C10 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C11 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C12 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C13 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C14 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| L2 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L4 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L6 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L7 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L8 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R2 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R3 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R4 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R5 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R6 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R7 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R8 | RES CC 24R .125W 5% | 24331-937H | U0914 | BB2405 |
| R9 | RES CC 36R .125W 5% | 24331-936Z | U0914 | BB3605 |
| R10 | RES CC 24R .125W 5% | 24331-937H | U0914 | BB2405 |
| R11 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R12 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R13 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R14 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R15 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA4a** | **- Translation Loop Mixer** | | (Contd.) | |
| R16 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R17 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R18 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R19 | RES CC 150R .125W 5% | 24331-990D | U0914 | BB1515 |
| R20 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| TR1 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR2 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR3 | TR NSI BFR96S 15V 5G - AMP | 28452-172N | K8996 | BFR96S |
| X1 | MOD RF TFM2 DOUBLE BAL MIXER | 28531-003Z | 15542 | TFM-2 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA5** | **- Translation Oscillator** | | | |
| 14. When ordering, prefix circuit reference with AA5 | | | | |
| | Complete unit | 44828-527S | U2632 | 44828-527S |
| C1 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C2 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C3 | CAP CER 6P8 63V .25P | 26343-463A | K8996 | 2222 682 |
| C4 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C5 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C6 | CAP CER 4P7 63V .25P | 26343-461B | K8996 | 2222 682 |
| C7 | CAP CER 3P9 63V .25P | 26343-496Z | K8996 | 2222 678 09398 |
| C8 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C9 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C10 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C12 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C13 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C14 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C15 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C16 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C17 | CAP CER 4P7 63V .25P | 26343-461B | K8996 | 2222 682 |
| C18 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C19 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C20 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C21 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C22 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C23 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C25 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C26 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C27 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C28 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C29 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C30 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C31 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C34 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C40 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C41 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C42 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| D1 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| L1 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L2 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA5** | **- Translation Oscillator** | | (Contd.) | |
| L4 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L5 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L6 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L7 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L9 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L10 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L11 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L12 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L14 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L15 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R4 | RES MF 12K .125W 2% 100PPM | 24772-099D | U0142 | CMF51 |
| R5 | RES MF 24K .125W 2% 100PPM | 24772-106T | U0142 | CMF51 |
| R6 | RV CERM 5K0 LI .5W 10% | 25711-640F | U0914 | E2A |
| R7 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R8 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R9 | RES MF 680R .125W 2% 100PPM | 24772-069P | U0142 | CMF51 |
| R10 | RES MF 910R .125W 2% 100PPM | 24772-072P | U0142 | CMF51 |
| R11 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R12 | RES CC 22R .125W 5% | 24331-988T | U0914 | BB2205 |
| R13 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R14 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R15 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R16 | RES MF 9K1 .125W 2% 100PPM | 24772-096V | U0142 | CMF51 |
| R18 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R19 | RES CC 82R .125W 5% | 24331-996R | U0914 | BB8205 |
| R20 | RES CC 100R .125W 5% | 24331-997B | U0914 | BB1015 |
| R21 | RES CC 82R .125W 5% | 24331-996R | U0914 | BB8205 |
| R22 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R23 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R24 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R25 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R26 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R27 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R28 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R29 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R30 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R31 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R32 | RES CC 16R .125W 5% | 24331-987D | | |
| R33 | RES CC 16R .125W 5% | 24331-987D | | |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA5** | **- Translation Oscillator** | (Contd.) | | |
| R34 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R35 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R36 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R37 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R38 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R39 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R40 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R41 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R42 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R43 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R44 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R50 | RES MF 10R .125W 2% 100PPM | 24772-025L | U0142 | CMF51 |
| R51 | RES MF 10R .125W 2% 100PPM | 24772-025L | U0142 | CMF51 |
| R52 | RES MF 10R .125W 2% 100PPM | 24772-025L | U0142 | CMF51 |
| TR1 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR2 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR3 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR4 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR5 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR6 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| T1 | TRIFILAR MATCHING TRANS | 43590-130R | U2632 | 43590-130R |
| T2 | BIFILAR OUTPUT TRANS | 43590-128B | U2632 | 43590-128B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA6** | **- Cavity Oscillator Buffer** | | | |
| 15. When ordering, prefix circuit reference with AA6 | | | | |
| | Complete unit | 44828-528W | U2632 | 44828-528W |
| C1 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C2 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C3 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C4 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C5 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C6 | CAP CER 4P7 63V .25P | 26343-461B | K8996 | 2222 682 |
| C7 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C8 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C9 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C10 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C11 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C12 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C13 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C14 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C15 | CAP CER 4P7 63V .25P | 26343-461B | K8996 | 2222 682 |
| C16 | CAP CER 5P6 63V .25P | 26343-486X | | |
| C17 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C18 | CAP CER 5P6 63V .25P | 26343-486X | | |
| C19 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C20 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C21 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C22 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C23 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C24 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C25 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C26 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C27 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C28 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C29 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C30 | CAP CER 2.2P 63V .25P | 26343-457R | K8996 | 2222 682 |
| C31 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C32 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C40 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C41 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C42 | CAP CER 5P6 63V .25P | 26343-486X | | |
| C43 | CAP CER 5P6 63V .25P | 26343-486X | | |
| L2 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA6** | **- Cavity Oscillator Buffer** (Contd.) | | | |
| L5 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L6 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L7 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L8 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L10 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L11 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L12 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L13 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L15 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L16 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L17 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L18 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L20 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R2 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R3 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R5 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R6 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R9 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R10 | RES CC 5R6 .125W 5% | 24331-940H | U0914 | BB56G5 |
| R11 | RES CC 5R6 .125W 5% | 24331-940H | U0914 | BB56G5 |
| R12 | RES CC 220R .125W 5% | 24331-976N | U0914 | BB2215 |
| R13 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R14 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R15 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R16 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R17 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R18 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R19 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R20 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R21 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R22 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R23 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R24 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R25 | RES CC 150R .125W 5% | 24331-990D | U0914 | BB1515 |
| R27 | RES CC 5R6 .125W 5% | 24331-940H | U0914 | BB56G5 |
| R28 | RES CC 220R .125W 5% | 24331-976N | U0914 | BB2215 |
| R29 | RES CC 5R6 .125W 5% | 24331-940H | U0914 | BB56G5 |
| R30 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R34 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA6** | **- Cavity Oscillator Buffer** | | (Contd.) | |
| R35 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R36 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R37 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R38 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R39 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R40 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R41 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R42 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R47 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R48 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R49 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R50 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R51 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R52 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R53 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R54 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R55 | RES CC 68R .125W 5% | 24331-979F | U0914 | BB6805 |
| R56 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R57 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R60 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R61 | RES MF 10R .125W 2% 100PPM | 24772-025L | U0142 | CMF51 |
| TR1 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR2 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR3 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR4 | TR NSI BFR96 15V 5G - AMP | 28452-171Y | K8996 | BFR96 OR /02 |
| TR5 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR6 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR7 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR8 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| T1 | TRIFILAR MATCHING TRANS | 43590-130R | U2632 | 43590-130R |
| T2 | BIFILAR OUTPUT TRANS | 43590-128B | U2632 | 43590-128B |
| T3 | TRIFILAR MATCHING TRANS | 43590-130R | U2632 | 43590-130R |
| T4 | BIFILAR OUTPUT TRANS | 43590-128B | U2632 | 43590-128B |
| X1 | MOD RF SBL-1X DBL BAL MXR 1GHZ | 28531-005E | 15542 | SBL-1X |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AA6a/1** | **- Cavity Oscillator** | | | |
| 16. When ordering, prefix circuit reference with AA6A/1 | | | | |
| | Complete unit | 44990-809R | U2632 | 44990-809R |
| C1 | CAP CER 1N0 500V 20%+ | 26373-714F | K8445 | K2600 361 |
| C2 | CAP CER 1N0 500V 20%+ | 26373-714F | K8445 | K2600 361 |
| C3 | CAP CER 500P 500V 25% | 26373-609F | K8445 | K120051 361 |
| C4 | CAP CER 1P0 100V .25PF NP0 RAD | 26343-574N | | |
| C5 | CAP CER 3P3 100V .25PF NP0 RAD | 26343-575L | | |
| C6 | CAP-VAR AIR 9P0 1P0 TRIM | 26814-502R | | |
| D1 | DI V/CAP 1N5145 4V 27PF | 28381-526K | K5519 | 1N5145 OR A |
| L1 | IND | 02383-202/ | | |
| L2 | IND | 02383-202/ | | |
| L3 | IND CHOKE 1.0UH 10% LAQ | 23642-549L | U4038 | SC10 13 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA6b/1** | **- Cavity Oscillator PCB** | | | |
| 17. When ordering, prefix circuit reference with AA6B/1 | | | | |
| | Complete unit | 44829-506L | U2632 | 44829-506L |
| C1 | CAP CER 47P 50V 5% | 26343-785G | U2109 | 08055A680JA3TR |
| C2 | CAP CER 47P 50V 5% | 26343-785G | U2109 | 08055A680JA3TR |
| C3 | CAP CER 1P0 50V .5P | 26386-800U | | |
| R1 | RES MG 47R .125W 5% | 24681-055S | U3613 | ERJ 8GC J470 |
| R2 | RES MG 47R .125W 5% | 24681-055S | U3613 | ERJ 8GC J470 |
| TR1 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA7** | **- Translation Loop** | | | |
| 18. When ordering, prefix circuit reference with AA7 | | | | |
| | Complete unit | 44828-529D | U2632 | 44828-529D |
| C1 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C2 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C3 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C4 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C5 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C6 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C7 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C8 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C9 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C10 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C11 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C12 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C13 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C14 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C15 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C16 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C17 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C18 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C19 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C20 | CAP CER 10P 63V 2% | 26343-465H | K8996 | 2222 682 |
| C21 | CAP CER 10P 63V 2% | 26343-465H | K8996 | 2222 682 |
| C22 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C23 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C24 | CAP CER 220P 63V 2% | 26343-481S | K8996 | 2222 682 |
| C25 | CAP CER 220P 63V 2% | 26343-481S | K8996 | 2222 682 |
| C26 | CAP CER 220P 63V 2% | 26343-481S | K8996 | 2222 682 |
| C27 | CAP CER 220P 63V 2% | 26343-481S | K8996 | 2222 682 |
| C28 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C29 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C30 | CAP CER 560P 63V 10% | 26383-581D | K8996 | 630-18 |
| C31 | CAP CER 560P 63V 10% | 26383-581D | K8996 | 630-18 |
| C32 | CAP ELEC 22U 25V 20% | 26421-114E | U4011 | K22/25 |
| C33 | CAP ELEC 22U 25V 20% | 26421-114E | U4011 | K22/25 |
| C34 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C35 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C36 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C37 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AA7** | **- Translation Loop** | | | (Contd.) | |
| C38 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C39 | CAP PETP 1U0 50V 10% | | 26582-432F | K1945 | R68 C C 1004 AAK |
| C40 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C41 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C48 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C49 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| D1 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| IC1 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC2 | ICD MUX 74LS157 QUAD 2INP | | 28469-707B | K5519 | SN74LS157N |
| IC3 | ICD CTR 74F191 4BIT BIN PRE | ! | 28464-145F | K6659 | 74F191PC |
| IC4 | ICD FF-D 74F74 DUAL +EDG TR | ! | 28462-113S | K5519 | MC74F74N |
| IC5 | ICD FF-D 74F74 DUAL +EDG TR | ! | 28462-113S | K5519 | MC74F74N |
| IC6 | ICD FF-D MC10131L | | 28462-605R | K5519 | MC10131 (L OR P) |
| IC7 | ICD NOR 10102 QUAD 2INP | | 28466-219G | K5519 | MC10102 (P OR L) |
| IC8 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC9 | ICA AMP TL071CP FET I/P DIL8 | | 28461-347A | K5519 | TL071CP |
| L1 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L2 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLC | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLD | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLE | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLF | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLG | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLH | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLJ | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 10R .25W 2% 100PPM | | 24773-225W | K8996 | MR25 |
| R2 | RES MF 1R0 .25W 2% 100PPM | | 24773-201M | U1395 | RC55 |
| R3 | RES MF 2R0 .25W 2% 100PPM | | 24773-208H | U1395 | RC55 |
| R4 | RES MF 10R .25W 2% 100PPM | | 24773-225W | K8996 | MR25 |
| R5 | RES MF 51R .25W 2% 100PPM | | 24773-242Z | K8996 | MR25 |
| R6 | RES MF 2K7 .25W 2% 100PPM | | 24773-283L | K8996 | MR25 |
| R7 | RES MF 2K7 .25W 2% 100PPM | | 24773-283L | K8996 | MR25 |
| R8 | RES MF 1K5 .25W 2% 100PPM | | 24773-277U | K8996 | MR25 |
| R9 | RES MF 100R .25W 2% 100PPM | | 24773-249J | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA7** | **- Translation Loop** (Contd.) | | | |
| R10 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R11 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R12 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R13 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R14 | RES MF 22R .25W 2% 100PPM | 24773-233M | K8996 | MR25 |
| R15 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R16 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R17 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R18 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R19 | RES MF 620R .25W 2% 100PPM | 24773-268B | K8996 | MR25 |
| R20 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R21 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R22 | RES MF 39R .25W 2% 100PPM | 24773-239Z | K8996 | MR25 |
| R23 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R24 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R25 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R26 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R27 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R28 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R29 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R30 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R31 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R32 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R33 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R34 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R35 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R36 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R37 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R38 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R39 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R40 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R41 | RN ISOL 1K0 2% 16DIL | 24681-521A | U4736 | 761 3 |
| R49 | RES MF 910R .25W 2% 100PPM | 24773-272K | K8996 | MR25 |
| R50 | RES MF 910R .25W 2% 100PPM | 24773-272K | K8996 | MR25 |
| R51 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R52 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R53 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R54 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R55 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R56 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R57 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R58 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA7** | **- Translation Loop** | | (Contd.) | |
| R59 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R60 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R61 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R62 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R63 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| TR1 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR2 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR3 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR4 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR5 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR6 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR7 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR8 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| X1 | CON JUMP FEM 2 9.6MM | 23435-990X | U2338 | 65474 001 |
| X2 | CON JUMP FEM 2 9.6MM | 23435-990X | U2338 | 65474 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA8** | **- Fractional Division PLL** | | | |
| 19. When ordering, prefix circuit reference with AA8 | | | | |
| | Complete unit | 44828-530S | U2632 | 44828-530S |
| C1 | CAP ELEC 22U 100V 20%+ | 26421-120N | U4011 | CEB22100 |
| C2 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C5 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C6 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C7 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C8 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C9 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C11 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C12 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C13 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C14 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C15 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C16 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C17 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C18 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C19 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C21 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C22 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C23 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C24 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C25 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C26 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C28 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C31 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C32 | CAP CER 820P 63V 10% | 26383-584X | K8996 | 630-18-821 |
| C33 | CAP CER 820P 63V 10% | 26383-584X | K8996 | 630-18-821 |
| C34 | CAP CER 820P 63V 10% | 26383-584X | K8996 | 630-18-821 |
| C35 | CAP CER 820P 63V 10% | 26383-584X | K8996 | 630-18-821 |
| C36 | CAP PETP 33N 63V 10% | 26582-435S | K1945 | R68 D C 3302 AAK |
| C37 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C38 | CAP PETP 33N 63V 10% | 26582-435S | K1945 | R68 D C 3302 AAK |
| C39 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C40 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C41 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C42 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C43 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C46 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AA8** | **- Fractional Division PLL** | | (Contd.) | | |
| C47 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C49 | CAP CER 10P 63V 2% | | 26343-465H | K8996 | 2222 682 |
| C50 | CAP CER 150P 63V 2% | | 26343-479W | K8996 | 2222 682 |
| C51 | CAP ELEC 33U 25V 20% | | 26421-115U | U4011 | K33/25 |
| C52 | CAP ELEC 33U 25V 20% | | 26421-115U | U4011 | K33/25 |
| C53 | CAP CER 22P 63V 2% | | 26343-469N | K8996 | 2222 682 |
| C54 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C55 | CAP ELEC 10U 35V 20% | | 26421-112Z | U4011 | K10/35 |
| C66 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C67 | CAP ELEC 1U0 50V 20% | | 26421-106B | U4011 | K1.0/50 |
| C68 | CAP ELEC 10U 35V 20% | | 26421-112Z | U4011 | K10/35 |
| D1 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D4 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| IC1 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC2 | ICD MUX 74LS157 QUAD 2INP | | 28469-707B | K5519 | SN74LS157N |
| IC3 | ICD CTR 74F191 4BIT BIN PRE | ! | 28464-145F | K6659 | 74F191PC |
| IC4 | ICD FF-D 74F74 DUAL +EDG TR | ! | 28462-113S | K5519 | MC74F74N |
| IC5 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC6 | ICD CTR 74F191 4BIT BIN PRE | ! | 28464-145F | K6659 | 74F191PC |
| IC7 | ICD NAND 74F00 QUAD 2INP | ! | 28466-359W | K5519 | MC74F00N |
| IC8 | ICD FF-JK 74F109 DUAL +EDG TR | ! | 28462-116T | K5519 | MC74F109N |
| IC9 | ICD CTR 74S196 4BIT DEC | | 28464-010J | K0461 | SN74S196(N OR J) |
| IC10 | ICD MUX 74LS251 8INP 3ST | | 28469-710B | K5519 | SN74LS251N |
| IC11 | ICD FF-JK 74F109 DUAL +EDG TR | ! | 28462-116T | K5519 | MC74F109N |
| IC12 | ICD FF-JK 74F109 DUAL +EDG TR | ! | 28462-116T | K5519 | MC74F109N |
| IC13 | ICD NOR 74F02 QUAD 2INP | ! | 28466-226D | K5519 | MC74F02N |
| IC14 | MOD HYB OM350 40-860MHZ AMP | | 28461-371T | K7584 | OM350 |
| IC15 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC16 | ICA MUX 4052 DUAL 4INP | ! | 28469-713Z | K5519 | MC14052BCP |
| IC17 | ICA SW 4066 QUAD BI | ! | 28469-383S | K5519 | MC14066BCP |
| IC18 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| L1 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L2 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L4 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L5 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L6 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA8** | **- Fractional Division PLL** (Contd.) | | | |
| PLC | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLD | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLE | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLF | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLG | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLH | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLJ | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLK | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R2 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R5 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R6 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R7 | RES MF 1K5 .125W 2% 100PPM | 24772-077B | U0142 | CMF51 |
| R8 | RES MF 2K7 .125W 2% 100PPM | 24772-083Z | U0142 | CMF51 |
| R9 | RES MF 2K7 .125W 2% 100PPM | 24772-083Z | U0142 | CMF51 |
| R10 | RES MF 1K2 .125W 2% 100PPM | 24772-075C | U0142 | CMF51 |
| R11 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R12 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R13 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R14 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R17 | RES MF 620R .125W 2% 100PPM | 24772-068T | | |
| R18 | RES MF 56R .125W 2% 100PPM | 24772-043C | U0142 | CMF51 |
| R19 | RES MF 330R .125W 2% 100PPM | 24772-061J | U0142 | CMF51 |
| R20 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R21 | RES MF 1K5 .125W 2% 100PPM | 24772-077B | U0142 | CMF51 |
| R22 | RES MF 2K7 .125W 2% 100PPM | 24772-083Z | U0142 | CMF51 |
| R23 | RES MF 2K7 .125W 2% 100PPM | 24772-083Z | U0142 | CMF51 |
| R24 | RES MF 1K2 .125W 2% 100PPM | 24772-075C | U0142 | CMF51 |
| R25 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R26 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R27 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R28 | RES MF 10R .125W 2% 100PPM | 24772-025L | U0142 | CMF51 |
| R29 | RES MF 1K8 .125W 2% 100PPM | 24772-079A | U0142 | CMF51 |
| R30 | RES MF 1K8 .125W 2% 100PPM | 24772-079A | U0142 | CMF51 |
| R31 | RES MF 16K .25W 2% 100PPM | 24773-302X | K8996 | MR25 |
| R32 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R33 | RES MF 11K .25W 2% 100PPM | 24773-298C | K8996 | MR25 |
| R34 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R35 | RES MF 16K .25W 2% 100PPM | 24773-302X | K8996 | MR25 |
| R36 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R37 | RES MF 11K .25W 2% 100PPM | 24773-298C | K8996 | MR25 |
| R38 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R39 | RN BUS -->24681-677P - - | 24681-628Y | K5743 | 4306R 101 221 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA8** | **- Fractional Division PLL** | (Contd.) | | |
| R40 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R42 | RN BUS -->24681-678X - - | 24681-646X | K5743 | 4306R-101-471-J |
| R44 | RES MF 1K8 .125W 2% 100PPM | 24772-079A | U0142 | CMF51 |
| R45 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R46 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R47 | RES MF 1K8 .125W 2% 100PPM | 24772-079A | U0142 | CMF51 |
| R48 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R49 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R50 | RN ISOL 1K0 2% 16DIL | 24681-521A | U4736 | 761 3 |
| R51 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R52 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R53 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R54 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R55 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R56 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R57 | RES MF 20K .125W 2% 100PPM | 24772-104W | U0142 | CMF51 |
| R58 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R59 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R60 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R61 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R62 | RES MF 1K3 .25W 2% 100PPM | 24773-276E | K8996 | MR25 |
| R63 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R64 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R65 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R66 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R67 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R68 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R69 | RES MF 22K .125W 2% 100PPM | 24772-105D | U0142 | CMF51 |
| R70 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R72 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R73 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R74 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R80 | RES MF 2K4 .125W 2% 100PPM | 24772-082A | U0142 | CMF51 |
| R81 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R82 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R83 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R85 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R86 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| TR1 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |
| TR2 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |
| TR3 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR4 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA8** | **- Fractional Division PLL** | | (Contd.) | |
| TR5 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR6 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR7 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR8 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR9 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR10 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR11 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR12 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR13 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR14 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR15 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR16 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| X1 | CON JUMP FEM 2 9.6MM | 23435-990X | U2338 | 65474 001 |
| X2 | CON JUMP FEM 2 9.6MM | 23435-990X | U2338 | 65474 001 |
| X3 | CON JUMP FEM 2 9.6MM | 23435-990X | U2338 | 65474 001 |
| X4 | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| X6 | S/C-ACC PAD TO18,ETC TO .1"GRD | 28488-115L | K1935 | TO18-019D |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA9/1** | **- 550 MHz VCO** | | | |
| 20. When ordering, prefix circuit reference with AA9/1 | | | | |
| | Complete unit | 44828-546H | U2632 | 44828-546H |
| C1 | CAP CER 220P 63V 10% | 26383-595H | K8996 | 630-18-221 |
| C2 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C3 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C4 | CAP ELEC 220U 16V 20%+ | 26421-124G | U4011 | CEB22016 |
| C5 | CAP CER 220P 63V 10% | 26383-595H | K8996 | 630-18-221 |
| C6 | CAP-VAR PLAS 5P5 1P4 TRIM | 26878-405H | K8996 | 2222 808 11A558 |
| C7 | CAP CER 220P 63V 10% | 26383-595H | K8996 | 630-18-221 |
| C8 | CAP ELEC 220U 16V 20%+ | 26421-124G | U4011 | CEB22016 |
| C9 | CAP CER 220P 63V 10% | 26383-595H | K8996 | 630-18-221 |
| C10 | CAP CER 220P 63V 10% | 26383-595H | K8996 | 630-18-221 |
| C11 | CAP CER 15P 50V 10% | 26343-571E | K3921 | VP31 BA 150KA |
| C12 | CAP CER 15P 50V 10% | 26343-571E | K3921 | VP31 BA 150KA |
| C13 | CAP CER 220P 63V 10% | 26383-595H | K8996 | 630-18-221 |
| C14 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C15 | CAP CER 220P 63V 10% | 26383-595H | K8996 | 630-18-221 |
| C16 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C17 | CAP CER 5P6 63V .25P | 26343-462K | K8996 | 2222 682 |
| C18 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C19 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C20 | CAP CER 3P9 63V .25P | 26343-460R | K8996 | 2222 682 |
| C21 | CAP CER 5P6 63V .25P | 26343-462K | K8996 | 2222 682 |
| C22 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C23 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C24 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C25 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C26 | CAP CER 3P9 63V .25P | 26343-460R | K8996 | 2222 682 |
| C27 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C28 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C30 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C31 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C32 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C33 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C34 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C35 | CAP CER 1NO 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C36 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C40 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C41 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA9/1** | **- 550 MHz VCO** | (Contd.) | | |
| C42 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C43 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C44 | CAP CER 2P7 63V .25P | 26343-458B | K8996 | 2222 682 |
| C45 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C46 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C50 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C51 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C53 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| D1 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D2 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| IC1 | MOD HYB OM345 VHF/UHF AMP SIL | 28461-351Z | K8996 | OM345 |
| L1 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L2 | IND CHOKE 2U2 10% MINIATURE | 23642-420F | U4251 | 550 3399 17 0200 |
| L7 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L8 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L9 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L11 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L12 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L13 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L14 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L16 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L17 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L18 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L19 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L21 | IND RF 30NH | 34900-916E | U2632 | 34900-916E |
| L22 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L23 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| PLV | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLW | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 10R .125W 2% 100PPM | 24772-025L | U0142 | CMF51 |
| R2 | RES MF 560R .125W 2% 100PPM | 24772-067D | U0142 | CMF51 |
| R3 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R4 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R5 | RES CC 10R .125W 5% | 24331-974U | U0914 | BB1005 |
| R6 | RES MF 200R .125W 2% 100PPM | 24772-056N | U0142 | CMF51 |
| R7 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R8 | RES CC 22R .125W 5% | 24331-988T | U0914 | BB2205 |
| R9 | RES CC 22R .125W 5% | 24331-988T | U0914 | BB2205 |
| R10 | RES CC 43R .125W 5% | 24331-995C | U0914 | BB4305 |
| R11 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA9/1** | **- 550 MHz VCO** | | (Contd.) | |
| R12 | RES MF 180R .125W 2% 100PPM | 24772-055Y | U0142 | CMF51 |
| R13 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R14 | RES CC 82R .125W 5% | 24331-996R | U0914 | BB8205 |
| R17 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R18 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R19 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R20 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R21 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R22 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R23 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R24 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R25 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R26 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R27 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R28 | RES CC 120R .125W 5% | 24331-998K | U0914 | BB1215 |
| R29 | RES CC 10R .125W 5% | 24331-974U | U0914 | BB1005 |
| R30 | RES CC 10R .125W 5% | 24331-974U | U0914 | BB1005 |
| R31 | RES CC 150R .125W 5% | 24331-990D | U0914 | BB1515 |
| R32 | RES CC 10R .125W 5% | 24331-974U | U0914 | BB1005 |
| R33 | RES CC 10R .125W 5% | 24331-974U | U0914 | BB1005 |
| R34 | RES CC 150R .125W 5% | 24331-990D | U0914 | BB1515 |
| R35 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R36 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R37 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R38 | RES MF 330R .125W 2% 100PPM | 24772-061J | U0142 | CMF51 |
| R39 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R40 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R41 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R42 | RES MF 200R .125W 2% 100PPM | 24772-056N | U0142 | CMF51 |
| R43 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R50 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R51 | RES MF 3K3 .125W 2% 100PPM | 24772-085E | U0142 | CMF51 |
| R52 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R53 | RES MF 330R .125W 2% 100PPM | 24772-061J | U0142 | CMF51 |
| R54 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R55 | RES MF 3K6 .125W 2% 100PPM | 24772-086U | U0142 | CMF51 |
| R56 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R57 | RES MF 200R .125W 2% 100PPM | 24772-056N | U0142 | CMF51 |
| R58 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R60 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R61 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| TR1 | TR NSI BFR91A 12V 6G - AMP | 28451-694H | K8996 | BFR91A |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA9/1** | **- 550 MHz VCO** | | (Contd.) | |
| TR3 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR4 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR5 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR6 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR7 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| TR9 | TR NSI BFR90 15V 5G - AMP | 28452-167U | K8996 | BFR90 OR /02 |
| T1 | TRIFILAR MATCHING TRANS | 43590-130R | U2632 | 43590-130R |
| T2 | BIFILAR OUTPUT TRANS | 43590-128B | U2632 | 43590-128B |
| T3 | TRIFILAR MATCHING TRANS | 43590-130R | U2632 | 43590-130R |
| T4 | BIFILAR OUTPUT TRANS | 43590-128B | U2632 | 43590-128B |
| X1 | TERM S/TAG 3X6.3LG PCB S/E | 35901-604J | U2632 | 35901-604J |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AA10/1** | **- 550 MHz Phase Detector** | | | | |
| 21. When ordering, prefix circuit reference with AA10/1 | | | | | |
| | Complete unit | | 44829-493A | U2632 | 44829-493A |
| C1 | CAP ELEC 33U 25V 20% | | 26421-115U | U4011 | K33/25 |
| C2 | CAP ELEC 33U 25V 20% | | 26421-115U | U4011 | K33/25 |
| C3 | CAP CER 2P7 63V .25P | | 26343-458B | K8996 | 2222 682 |
| C4 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C5 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C6 | CAP CER 39P 63V 2% | | 26343-472N | K8996 | 2222 682 |
| C7 | CAP CER 56P 63V 2% | | 26343-474J | K8996 | 2222 682 |
| C8 | CAP CER 3P9 63V .25P | | 26343-460R | K8996 | 2222 682 |
| C10 | CAP CER 4P7 63V .25P | | 26343-461B | K8996 | 2222 682 |
| C11 | CAP CER 22P 63V 2% | | 26343-469N | K8996 | 2222 682 |
| C12 | CAP CER 22P 63V 2% | | 26343-469N | K8996 | 2222 682 |
| C13 | CAP CER 10P 63V 2% | | 26343-465H | K8996 | 2222 682 |
| C14 | CAP CER 10P 63V 2% | | 26343-465H | K8996 | 2222 682 |
| C15 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C16 | CAP ELEC 33U 25V 20% | | 26421-115U | U4011 | K33/25 |
| C17 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C18 | CAP CER 1N0 63V 10% | | 26383-585M | K8996 | 630-18-102 |
| C20 | CAP CER 47P 63V 2% | | 26343-433H | K8996 | 2222 678 34479 |
| C23 | CAP PETP 220N 63V 10% | | 26582-430L | K1945 | R68 D C 2203 AAK |
| C24 | CAP PETP 220N 63V 10% | | 26582-430L | K1945 | R68 D C 2203 AAK |
| C26 | CAP PETP 47N 63V 10% | | 26582-428J | K1945 | R68 D C 4702 AAK |
| C29 | CAP ELEC 33U 25V 20% | | 26421-115U | U4011 | K33/25 |
| D1 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D2 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D3 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D4 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D5 | M/WV DI STEP HP5082-180 1.5GHZ | | 28383-998P | K3464 | HP5082 0180 |
| D6 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D8 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D9 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| IC1 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC2 | ICA AMP NE5532 DUAL LN DIL8 | | 28461-363G | K0461 | NE5532N |
| IC3 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| L1 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | | 44190-036B | U2632 | 44190-036B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA10/1** | **- 550 MHz Phase Detector** | | (Contd.) | |
| L6 | IND CHOKE 22UH 10% LAQ | 23642-557S | U4038 | SC10 29 |
| PLAB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAC | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAD | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLNP | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R2 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R3 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R4 | RES MF 4K3 .125W 2% 100PPM | 24772-088N | U0142 | CMF51 |
| R5 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R6 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R7 | RES CC 150R .125W 5% | 24331-990D | U0914 | BB1515 |
| R10 | RES CC 180R .125W 5% | 24331-961X | U0914 | BB1815 |
| R11 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R12 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R13 | RES CC 100R .125W 5% | 24331-997B | U0914 | BB1015 |
| R14 | RES CC 100R .125W 5% | 24331-997B | U0914 | BB1015 |
| R15 | RES CC 200R .125W 5% | 24331-999A | U0914 | BB2015 |
| R16 | RES MF 2K0 .125W 2% 100PPM | 24772-080B | U0142 | CMF51 |
| R17 | RES MF 470R .125W 2% 100PPM | 24772-065S | U0142 | CMF51 |
| R18 | RES MF 2K0 .125W 2% 100PPM | 24772-080B | U0142 | CMF51 |
| R19 | RES MF 51R .125W 2% 100PPM | 24772-042M | U0142 | CMF51 |
| R20 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R21 | RES MF 3K0 .125W 2% 100PPM | 24772-084H | U0142 | CMF51 |
| R22 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R23 | RES MF 180K .125W 2% 100PPM | 24772-127L | U0142 | CMF51 |
| R24 | RES MF 180K .125W 2% 100PPM | 24772-127L | U0142 | CMF51 |
| R25 | RES MF 18K .125W 2% 100PPM | 24772-103S | U0142 | CMF51 |
| R26 | RES MF 150R .125W 2% 100PPM | 24772-053E | U0142 | CMF51 |
| R27 | RES MF 33K .125W 2% 100PPM | 24772-109M | U0142 | CMF51 |
| R28 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R29 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R30 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R31 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R32 | RES MF 30K .125W 2% 100PPM | 24772-108X | U0142 | CMF51 |
| R33 | RES MF 62K .125W 2% 100PPM | 24772-116K | U0142 | CMF51 |
| R35 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| TR1 | TR NSI BFR96 15V 5G - AMP | 28452-171Y | K8996 | BFR96 OR /02 |
| TR2 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR3 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA10/1** | **- 550 MHz Phase Detector** | | (Contd.) | |
| T1 | TRANSFORMER ASSY. | 43590-165A | U2632 | 43590-165A |
| X1 | TERM S/TAG 3X6.3LG PCB S/E | 35901-604J | U2632 | 35901-604J |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA11** | **- Line Cleaner** | | | |
| 22. When ordering, prefix circuit reference with AA11 | | | | |
| | Complete unit | 44828-533T | U2632 | 44828-533T |
| C1 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C2 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C3 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C4 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C5 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C6 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C7 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C8 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C13 | CAP PETP 47N 63V 10% | 26582-428J | K1945 | R68 D C 4702 AAK |
| C21 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C22 | CAP TANT 15U 16V 20% | 26486-227B | U3613 | SH |
| C23 | CAP TANT 15U 16V 20% | 26486-227B | U3613 | SH |
| C24 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C25 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C26 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C27 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C28 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C29 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| D1 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D4 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D6 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D8 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D9 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D11 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D12 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| IC1 | ICA AMP LF357N FET I/P LN DIL8 | 28461-356N | K7093 | LF357N |
| IC2 | ICA AMP LF357N FET I/P LN DIL8 | 28461-356N | K7093 | LF357N |
| IC3 | ICA AMP LF357N FET I/P LN DIL8 | 28461-356N | K7093 | LF357N |
| IC4 | ICA AMP LF357N FET I/P LN DIL8 | 28461-356N | K7093 | LF357N |
| L1 | IND CHOKE 68UH 10% LAQ | 23642-560S | U4038 | SC10 35 |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA11** | **- Line Cleaner** (Contd.) | | | |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLD | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLE | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 82K .125W 2% 100PM | 24772-119H | U0142 | CMF51 |
| R2 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R3 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R4 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R5 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R6 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R7 | RES MF 51R .125W 2% 100PPM | 24772-042M | U0142 | CMF51 |
| R8 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R9 | RES MF 30K .125W 2% 100PPM | 24772-108X | U0142 | CMF51 |
| R10 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R11 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R12 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R13 | RES MF 39R .25W 2% 100PPM | 24773-239Z | K8996 | MR25 |
| R14 | RES MF 33K .125W 2% 100PPM | 24772-109M | U0142 | CMF51 |
| R15 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R16 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R17 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R18 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R19 | RES MF 39R .25W 2% 100PPM | 24773-239Z | K8996 | MR25 |
| R20 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R21 | RES MF 82K .125W 2% 100PM | 24772-119H | U0142 | CMF51 |
| R22 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R23 | RES MF 2R4 .25W 2% 100PPM | 24773-210Z | U1395 | RC55 |
| R24 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R25 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R26 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R27 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R28 | RES MF 22R .125W 2% 100PPM | 24772-033S | U0142 | CMF51 |
| R29 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R31 | RES MF 82K .125W 2% 100PM | 24772-119H | U0142 | CMF51 |
| R32 | RES MF 68K .125W 2% 100PPM | 24772-117A | U0142 | CMF51 |
| R33 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R34 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R35 | RES MF 68K .125W 2% 100PPM | 24772-117A | U0142 | CMF51 |
| R36 | RES MF 82K .125W 2% 100PM | 24772-119H | U0142 | CMF51 |
| R37 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R41 | RV THERM 47K NTC 60MW 20% | 25685-241S | K8996 | VA 3410 |
| TR1 | TR PSI 2N2905A 60V 200M - GEN | 28435-868C | K6617 | 2N2905A |
| TR2 | TR PSI 2N2905A 60V 200M - GEN | 28435-868C | K6617 | 2N2905A |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA11** | **- Line Cleaner** | (Contd.) | | |
| TR3 | TR NSI 2N2219A 40V 300M - GEN | 28454-804V | K5519 | 2N2219A |
| TR4 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR5 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AA12** | **- Divide By 16** | | | |
| 23. When ordering, prefix circuit reference with AA12 | | | | |
| | Complete unit | 44828-534P | U2632 | 44828-534P |
| C1 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C2 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C3 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C4 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C5 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| D1 | DI SIL BA482 35V JUNC | 28335-675R | K8996 | BA482 |
| IC1 | ICD DIV SP8650B/16 600M DIL14 | 28469-437H | K0467 | SP8650B |
| L1 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 47K .125W 2% 100PPM | 24772-113C | U0142 | CMF51 |
| R2 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R3 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R4 | RES MF 27K .125W 2% 100PPM | 24772-107P | U0142 | CMF51 |
| R5 | RES MF 820R .125W 2% 100PPM | 24772-071T | U0142 | CMF51 |
| R6 | RES MF 820R .125W 2% 100PPM | 24772-071T | U0142 | CMF51 |
| R7 | RES MF 820R .125W 2% 100PPM | 24772-071T | U0142 | CMF51 |
| TR1 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AB0** | **- AB Tray Assembly** | | | |
| 24. When ordering, prefix circuit reference with AB0 | | | | |
| | Complete unit | 44990-661S | U2632 | 44990-661S |
| C1 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C2 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C3 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C4 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C5 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C6 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C7 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C8 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C9 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C10 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C11 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C12 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C13 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C14 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C15 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C16 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C17 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C18 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C19 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C20 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C21 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C22 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C23 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C24 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C25 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C26 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C27 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C28 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C29 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C30 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C31 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C32 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C33 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C34 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C35 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C36 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C39 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit ABO** | **- AB Tray Assembly** | (Contd.) | | |
| C40 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C41 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C42 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C43 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C44 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C45 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C46 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C47 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C49 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C50 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C51 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C52 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C53 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C54 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C55 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C56 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C57 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C58 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C59 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C60 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C61 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C62 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C63 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C64 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C65 | CAP ELEC 22U 100V 20%+ | 26421-120N | U4011 | CEB22100 |
| L1 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L2 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L4 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L5 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L6 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L7 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L8 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L9 | IND CHOKE 100UH 10% LAQ | 23642-561W | U4038 | SC10 37 |
| L10 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L11 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L12 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L13 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L14 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L15 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L16 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L17 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AB0** | **- AB Tray Assembly** | | (Contd.) | |
| L18 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L19 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L20 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L21 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L22 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L23 | IND CHOKE 47UH 10% LAQ | 23642-559D | U4038 | SC10 33 |
| L24 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L25 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L26 | IND CHOKE 47UH 10% LAQ | 23642-559D | U4038 | SC10 33 |
| L27 | IND | 34900-918Y | U2632 | 34900-918Y |
| L28 | IND LF 1MH PWR | 44190-042Z | U2632 | 44190-042Z |
| L29 | IND LF 1MH PWR | 44190-042Z | U2632 | 44190-042Z |
| L30 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| MP12 | Connector Assy 1R2W AB5 PLAK | 43130-881J | U2632 | 43130-881J |
| MP13 | Connector Assy 1R4W AB5/AB6 | 43130-823D | U2632 | 43130-823D |
| MP14 | 14W Ribbon Cable AB1/AB8 | 43137-204D | U2632 | 43137-204D |
| MP28 | Connector Assy 1R5W AB1 PLAE | 43137-039B | U2632 | 43137-039B |
| MP29 | Connector Assy 1R5W AB2 PLN | 43130-831C | U2632 | 43130-831C |
| MP33 | Connector Assy 1R5W AB2 PLP | 43130-833B | U2632 | 43130-833B |
| MP34 | CON-PART MIN HOUSING 1ROW 2P | 23435-167C | | |
| MP35 | Connector Assy 1R5W AB6 PLT | 43130-834K | U2632 | 43130-834K |
| MP36 | Connector Assy 1R5W AB4 PLAM | 43130-835A | U2632 | 43130-835A |
| MP37 | CON-PART MIN HOUSING 1ROW 5P | 23435-168R | | |
| MP38 | Connector Assy 1R2W AB3 PLV | 43130-836Z | U2632 | 43130-836Z |
| MP39 | Connector Assy 1R6W AB3 PLX | 43130-838E | U2632 | 43130-838E |
| MP40 | Connector Assy 1R6W AB3 PLW | 43130-839U | U2632 | 43130-839U |
| MP41 | Connector Assy 1R4W AB1 PLD | 43137-035X | U2632 | 43137-035X |
| MP42 | CON-PART MIN POLARIZING KEY | 23435-190G | | |
| MP43 | Connector Assy 1R6W AB1 PLH | 43137-040C | U2632 | 43137-040C |
| MP44 | Connector Assy 1R6W AB7 PLAA | 43130-840H | U2632 | 43130-840H |
| MP45 | Connector Assy 1R6W AB5 PLAJ | 43130-841E | U2632 | 43130-841E |
| MP46 | Connector Assy 1R3W AD38 PLJ | 43130-852V | U2632 | 43130-852V |
| MP48 | Connector Assy AB8/AR2 | 43137-041R | U2632 | 43137-041R |
| MP49 | Connector Assy AB1/AR2 | 43137-042B | U2632 | 43137-042B |
| MP50 | Scr Crimped Lead AB7 PLAC | 43130-859M | U2632 | 43130-859M |
| MP51 | Connector Assy 1R5W AB1 PLL | 43130-879F | U2632 | 43130-879F |
| MP53 | Connector Assy 1R6W AB1 PLJ | 43130-880L | U2632 | 43130-880L |
| MP54 | Connector Assy AA12/AB7 | 43137-244C | U2632 | 43137-244C |
| PLAQ | CON-RF SMB-MALE 50RR BKHD ELB | 23444-351P | K1072 | GE65209MBN |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | | | |
| 25. When ordering, prefix circuit reference with AB1 | | | | |
| | Complete unit | 44828-547E | U2632 | 44828-547E |
| C1 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C2 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C3 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C4 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C5 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C6 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C7 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C8 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C9 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C10 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C11 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C12 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C13 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C14 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C15 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C16 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C17 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C18 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C19 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C20 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C21 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C22 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C23 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C24 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C25 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C26 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C27 | CAP PETP 2U2 63V 10% | 26582-418Z | K8283 | A1B22201B |
| C28 | CAP PETP 2U2 63V 10% | 26582-418Z | K8283 | A1B22201B |
| C29 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C30 | CAP PETP 5U6 63V 10% | 26582-423E | K8283 | M2B56201B |
| C31 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C32 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C33 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C34 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C35 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C36 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C37 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | (Contd.) | | |
| C38 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C39 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C40 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C41 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C42 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C43 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C44 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C45 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C46 | CAP ELEC 1000U 6V 20%+ | 26421-128D | U4011 | CEB10006 |
| C47 | CAP ELEC 47U 63V 20%+ | 26421-121L | U4011 | CEB4763 |
| C48 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C49 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C50 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C51 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C52 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C53 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C54 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C55 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C56 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C57 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C58 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C59 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C60 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C61 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C62 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C63 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C64 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C66 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C67 | CAP CER 33P 63V 2% | 26343-471Y | K8996 | 2222 682 |
| C68 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C69 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C70 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C71 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C72 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C73 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C74 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C75 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C76 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C77 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C78 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C79 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C80 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C81 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | (Contd.) | | |
| C82 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C83 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C84 | CAP ELEC 22U 100V 20%+ | 26421-120N | U4011 | CEB22100 |
| C85 | CAP PETP 100N 100V 10% | 26582-211B | K8300 | PMT2R OR PMC2R |
| C86 | CAP ELEC 2U2 50V 20% | 26421-009E | U2475 | LRVB 2.2/50M |
| C87 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C89 | CAP ELEC 220U 16V 20%+ | 26421-124G | U4011 | CEB22016 |
| C90 | CAP ELEC 220U 16V 20%+ | 26421-124G | U4011 | CEB22016 |
| C91 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C92 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C93 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C94 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C95 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C96 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C97 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C98 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C99 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C100 | CAP TANT 15U 16V 20% | 26486-227B | U3613 | SH |
| C101 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C102 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C103 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C104 | CAP PETP 47N 63V 10% | 26582-428J | K1945 | R68 D C 4702 AAK |
| C105 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C106 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C107 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C108 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C109 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C110 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C111 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C112 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C113 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C114 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C115 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C116 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C117 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C118 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C119 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C120 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C121 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C122 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C123 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C124 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | (Contd.) | | |
| C125 | CAP ELEC 1000U 6V 20%+ | 26421-128D | U4011 | CEB10006 |
| C126 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C130 | CAP PETP 15N 63V 10% | 26582-434V | K1945 | R68 D C 1502 AAK |
| C135 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C136 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| D1 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D4 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D6 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D8 | DI H/CARR HP5082-2080 .34V SET ! | 28349-012Y | K3464 | HP5082 2080 |
| D9 | LAMP LED HLMP1301 2.4V RED | 28624-136W | K3464 | HLMP1301 |
| D10 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D11 | LAMP LED HLMP1301 2.4V RED | 28624-136W | K3464 | HLMP1301 |
| D12 | LAMP LED HLMP1401 2.4V YELLOW | 28624-137D | K3464 | HLMP1401 |
| D13 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D14 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D15 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D16 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D17 | LAMP LED HLMP1301 2.4V RED | 28624-136W | K3464 | HLMP1301 |
| D18 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D19 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D20 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| D21 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D22 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D23 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| D24 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D25 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D26 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D27 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D28 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| D29 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D30 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D31 | DI H/CARR HP5082-2080 .34V SET ! | 28349-012Y | K3464 | HP5082 2080 |
| D35 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D38 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D39 | DI ZEN BZX79C7V5 7.5V 5% | 28371-602Z | K8996 | BZX79 C7V5 |
| IC1 | ICA DAC 888FX 8BIT LATCHED I/P | 28469-434K | 06665 | DAC-888FX OR EX |
| IC2 | ICA AMP NE5534AN H-PRF DIL8 | 28461-358J | K0461 | NE5534AP |
| IC3 | ICA DAC 80-CBI-I 12BIT | 28541-011L | K7284 | AD DAC 80D-CBI-I |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| Board AB1 | - D - A Converter | | (Contd.) | | |
| IC4 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC5 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC6 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC7 | ICD CTR 74LS191 4BIT BIN U/D | | 28464-022X | K5519 | SN74LS191N |
| IC8 | ICD CTR 74LS191 4BIT BIN U/D | | 28464-022X | K5519 | SN74LS191N |
| IC9 | ICD CTR 74LS191 4BIT BIN U/D | | 28464-022X | K5519 | SN74LS191N |
| IC10 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC11 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC12 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC13 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC14 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC15 | ICA SW SD5002 QUAD DMOS 7.5V | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC16 | ICA SW SD5002 QUAD DMOS 7.5V | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC17 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC18 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC19 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC20 | ICA SW SD5002 QUAD DMOS 7.5V | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC21 | ICA AMP TL071CP FET I/P DIL8 | | 28461-347A | K5519 | TL071CP |
| IC22 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC23 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC24 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC25 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC26 | ICA AMP LM358N DUAL GP DIL8 | | 28461-342M | K5519 | MLM358PIORLM358N |
| IC27 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC28 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC29 | ICA DAC DAC08CQ 8BIT FAST MULT | | 28469-395B | 06665 | DAC-08CQ |
| IC30 | ICA DAC DAC08CQ 8BIT FAST MULT | | 28469-395B | 06665 | DAC-08CQ |
| IC31 | ICA DAC DAC08CQ 8BIT FAST MULT | | 28469-395B | 06665 | DAC-08CQ |
| IC32 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC33 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC34 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC35 | ICA VREF REF-02EJ 5V TO99 | | 28461-920W | U3418 | REF 02ET |
| IC36 | ICA DAC AD7524JN 8BIT | ! | 28469-400R | K7284 | AD7524JN OR AD |
| IC37 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC38 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC39 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC40 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC41 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC42 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC43 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC44 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC45 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC46 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | | | (Contd.) | |
| IC47 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC48 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC49 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC50 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC51 | ICA SW DG211CJ QUAD CMOS | ! | 28461-936E | K7068 | DG211CJ |
| IC52 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC53 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC54 | ICD BUFF 74LS244 OCT 3ST | | 28469-182T | K5519 | SN74LS244N |
| IC55 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC56 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC57 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC58 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| IC59 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| IC60 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| IC61 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| L1 | IND RF 320uH | | 44190-038A | U2632 | 44190-038A |
| L2 | IND CHOKE 68UH 10% LAQ | | 23642-560S | U4038 | SC10 35 |
| MP9 | CON JUMP FEM 2 9.6MM | | 23435-990X | U2338 | 65474 001 |
| PLD | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLE | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLH | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLJ | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLK | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLL | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLM | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAE | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAH | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAJ | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAK | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAY | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLSD | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLTA | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLTB | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLTC | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLTD | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLTE | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLTF | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 5K1 .25W 2% 100PPM | | 24773-290V | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | | (Contd.) | |
| R2 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R3 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R4 | RES MF 51K .25W 2% 100PPM | 24773-314E | K8996 | MR25 |
| R5 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R6 | RES MF 10K0 .25W .1% 50PPM | 24723-405W | K8479 | H8 |
| R7 | RES MF 4K99 .25W .1% 50PPM | 24723-406D | K8479 | H8 |
| R8 | RES MF 1K0 .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R9 | RES MF 1K5 .25W 0.1% 50PPM | 24723-302S | K8479 | H8 |
| R10 | RES MF 499R .25W .1% 50PPM | 24723-408P | K8479 | H8 |
| R11 | RES MF 1K0 .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R12 | RES MF 499R .25W .1% 50PPM | 24723-408P | K8479 | H8 |
| R13 | RES MF 499R .25W .1% 50PPM | 24723-408P | K8479 | H8 |
| R14 | RES MF 20R .25W 2% 100PPM | 24773-232X | K8996 | MR25 |
| R15 | RES MF 16K .25W 2% 100PPM | 24773-302X | K8996 | MR25 |
| R16 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R17 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R18 | RN ISOL 220K 2% 16DIL | 24681-505W | U4736 | 761 3 |
| R19 | RN ISOL 220K 2% 16DIL | 24681-505W | U4736 | 761 3 |
| R20 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R21 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R22 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R23 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R24 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R25 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R26 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R27 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R28 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R29 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R30 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R31 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R32 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R33 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R34 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R35 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R36 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R37 | RN ISOL 20K 0.5% 16DIL | 24681-518A | K0718 | 698 3 R20K-D |
| R38 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R39 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R40 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R41 | RES MF 430R .25W 2% 100PPM | 24773-264X | K8996 | MR25 |
| R42 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R43 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R44 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | (Contd.) | | |
| R45 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R46 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R47 | RES MF 5KO .25W .1% 50PPM | 24723-401F | K8479 | H8 |
| R48 | RES MF 320K .25W .1% 50PPM | 24723-404S | K8479 | H8 |
| R49 | RES MF 5KO .25W .1% 50PPM | 24723-401F | K8479 | H8 |
| R50 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R51 | RES MF 320K .25W .1% 50PPM | 24723-404S | K8479 | H8 |
| R52 | RES MF 5KO .25W .1% 50PPM | 24723-401F | K8479 | H8 |
| R53 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R54 | RES MF 2KO .25W .1% 50PPM | 24723-402G | K8479 | H8 |
| R55 | RES MF 2KO .25W .1% 50PPM | 24723-402G | K8479 | H8 |
| R56 | RES MF 2KO .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R57 | RES MF 1KO .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R58 | RES MF 1KO .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R59 | RES MF 2KO .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R60 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R61 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R62 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R63 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R64 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R65 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R66 | RES MF 20KO .25W 0.5% 50PPM | 24753-663N | K8479 | H8 |
| R67 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R68 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R69 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R70 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R71 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R72 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R73 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R74 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R75 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R76 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R77 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R78 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R79 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R80 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R81 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R82 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R83 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R84 | RV CERM 2KO LI .5W 10% | 25711-639V | U0914 | E2A |
| R85 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R86 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1 - D - A Converter** | | (Contd.) | | |
| R87 | RES MF 3K0 .125W 2% 100PPM | 24772-084H | U0142 | CMF51 |
| R88 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R89 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R90 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R91 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R92 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R93 | RES MF 36K .125W 2% 100PPM | 24772-110P | U0142 | CMF51 |
| R94 | RES MF 910R .125W 2% 100PPM | 24772-072P | U0142 | CMF51 |
| R95 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R96 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R97 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R98 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R99 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R100 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R101 | RES MF 3K9 .25W 2% 100PPM | 24773-287V | K8996 | MR25 |
| R102 | RES MF 3K9 .125W 2% 100PPM | 24772-087Y | U0142 | CMF51 |
| R103 | RES MF 150K .25W 2% 100PPM | 24773-325V | K8996 | MR25 |
| R104 | RES MF 2K2 .125W 2% 100PPM | 24772-081K | U0142 | CMF51 |
| R105 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R106 | RES MF 75K .25W 2% 100PPM | 24773-318L | K8996 | MR25 |
| R107 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R108 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R109 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R110 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R111 | RES MF 13K .125W 2% 100PPM | 24772-100F | U0142 | CMF51 |
| R112 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R113 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R114 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R115 | RES MF 270K .25W 2% 100PPM | 24773-331D | K8996 | MR25 |
| R118 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R119 | RES MF 3K9 .25W 2% 100PPM | 24773-287V | K8996 | MR25 |
| R120 | RES MF 3K9 .25W 2% 100PPM | 24773-287V | K8996 | MR25 |
| R121 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R122 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R123 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R124 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R125 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R126 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R127 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R128 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R129 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R130 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R131 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | | (Contd.) | |
| R132 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R133 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R134 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R135 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R136 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R137 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R138 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R139 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R140 | RES MF 62K .125W 2% 100PPM | 24772-116K | U0142 | CMF51 |
| R141 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R142 | RV CERM 50K LI .5W 10% | 25711-643S | U0914 | E2A |
| R143 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R146 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R147 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R148 | RES MF 7R5 .25W 2% 100PPM | 24773-222G | U1395 | RC55 |
| R149 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R150 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R151 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R152 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R156 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R157 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R158 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R159 | RES MF 130K .25W 2% 100PPM | 24773-324G | K8996 | MR25 |
| R160 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R161 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R162 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R163 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R164 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R165 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R166 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R167 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R168 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R169 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R170 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R171 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R172 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R173 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R174 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R175 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R176 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R177 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R178 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | (Contd.) | | |
| R179 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R180 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R181 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R182 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R183 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R184 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R185 | RES MF 39R .25W 2% 100PPM | 24773-239Z | K8996 | MR25 |
| R186 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R187 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R188 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R189 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R190 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R191 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R192 | RES MF 2R4 .25W 2% 100PPM | 24773-210Z | U1395 | RC55 |
| R193 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R194 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R195 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R196 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R197 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R200 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R201 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R202 | RES MF 36K .25W 2% 100PPM | 24773-310K | K8996 | MR25 |
| R210 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R211 | RES MF 30K .125W 2% 100PPM | 24772-108X | U0142 | CMF51 |
| SA | SW SLIDE 7NO 25V DIL | 23467-311R | U4736 | 206 007 |
| TR1 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR2 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR3 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR4 | TR PSI BC307A 45V 130M - GEN | 28435-227H | K6360 | BC307A |
| TR5 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR6 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR7 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR8 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR9 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR10 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR11 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR12 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR13 | TR NJF J310 25V - 24MA | 28459-028E | K5519 | J310 |
| TR14 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR15 | TR NJF J310 25V - 24MA | 28459-028E | K5519 | J310 |
| TR16 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR17 | TR PSI BC307A 45V 130M - GEN | 28435-227H | K6360 | BC307A |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1** | **- D - A Converter** | | (Contd.) | |
| TR18 | TR PSI BC450 100V 200M | 28438-259F | K5519 | BC450 |
| TR19 | TR NSI TIP112 100V 5M DAR | 28457-822L | K5519 | TIP112 |
| TR20 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR21 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR22 | TR PSI 2N2905A 60V 200M - GEN | 28435-868C | K6617 | 2N2905A |
| TR23 | TR PSI 2N2905A 60V 200M - GEN | 28435-868C | K6617 | 2N2905A |
| TR24 | TR NSI 2N2219A 40V 300M - GEN | 28454-804V | K5519 | 2N2219A |
| TR25 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR26 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR27 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR30 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1** | **- D - A Converter** | | | |
| 26. When ordering, prefix circuit reference with AB1/1 | | | | |
| | Complete unit | 44829-507J | U2632 | 44829-507J |
| C1 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C2 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C3 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C4 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C5 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C6 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C7 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C8 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C9 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C10 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C11 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C12 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C13 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C14 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C15 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C16 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C17 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C18 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C19 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C20 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C21 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C22 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C23 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C24 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C25 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C26 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C27 | CAP PETP 2U2 63V 10% | 26582-418Z | K8283 | A1B22201B |
| C28 | CAP PETP 2U2 63V 10% | 26582-418Z | K8283 | A1B22201B |
| C29 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C30 | CAP PETP 5U6 63V 10% | 26582-423E | K8283 | M2B56201B |
| C31 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C32 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C33 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C34 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C35 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C36 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C37 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1** | **- D - A Converter** | (Contd.) | | |
| C38 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C39 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C40 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C41 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C42 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C43 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C44 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C45 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C46 | CAP ELEC 1000U 6V 20%+ | 26421-128D | U4011 | CEB10006 |
| C47 | CAP ELEC 47U 63V 20%+ | 26421-121L | U4011 | CEB4763 |
| C48 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C49 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C50 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C51 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C52 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C53 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C54 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C55 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C56 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C57 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C58 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C59 | CAP PETP 68N 63V 10% | 26582-436W | K1945 | R68 D C 6802 AAK |
| C60 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C61 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C62 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C63 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C64 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C66 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C67 | CAP CER 33P 63V 2% | 26343-494K | | |
| C68 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C69 | CAP CER 33P 63V 2% | 26343-494K | | |
| C70 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C71 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C72 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C73 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C74 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C75 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C76 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C77 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C78 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C79 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C80 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C81 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1 - D - A Converter** | | (Contd.) | | |
| C82 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C83 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C84 | CAP ELEC 22U 100V 20%+ | 26421-120N | U4011 | CEB22100 |
| C85 | CAP PETP 100N 100V 10% | 26582-211B | K8300 | PMT2R OR PMC2R |
| C86 | CAP ELEC 2U2 50V 20% | 26421-009E | U2475 | LRVB 2.2/50M |
| C87 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C89 | CAP ELEC 220U 16V 20%+ | 26421-124G | U4011 | CEB22016 |
| C90 | CAP ELEC 220U 16V 20%+ | 26421-124G | U4011 | CEB22016 |
| C91 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C92 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C93 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C94 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C95 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C96 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C97 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C98 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C99 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C100 | CAP TANT 15U 16V 20% | 26486-227B | U3613 | SH |
| C101 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C102 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C103 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C104 | CAP PETP 47N 63V 10% | 26582-428J | K1945 | R68 D C 4702 AAK |
| C105 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C106 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C107 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C108 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C109 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C110 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C111 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C112 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C113 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C114 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C115 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C116 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C117 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C118 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C119 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C120 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C121 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C122 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C123 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C124 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1 - D - A Converter** | | (Contd.) | | |
| C125 | CAP ELEC 1000U 6V 20%+ | 26421-128D | U4011 | CEB10006 |
| C126 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C130 | CAP PETP 15N 63V 10% | 26582-434V | K1945 | R68 D C 1502 AAK |
| C135 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C136 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C137 | CAP PETP 22N 63V 10% | 26582-431J | K1945 | R68 D C 2202 AAK |
| C138 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C139 | CAP CER 1N8 63V 10% | 26383-586C | K8996 | 630-18-182 |
| D1 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D4 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D6 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D8 | DI H/CARR HP5082-2080 .34V SET ! | 28349-012Y | K3464 | HP5082 2080 |
| D9 | LAMP LED HLMP1301 2.4V RED | 28624-136W | K3464 | HLMP1301 |
| D10 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D11 | LAMP LED HLMP1301 2.4V RED | 28624-136W | K3464 | HLMP1301 |
| D12 | LAMP LED HLMP1401 2.4V YELLOW | 28624-137D | K3464 | HLMP1401 |
| D13 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D14 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D15 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D16 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D17 | LAMP LED HLMP1301 2.4V RED | 28624-136W | K3464 | HLMP1301 |
| D18 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D19 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D20 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| D21 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D22 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D23 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| D24 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D25 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D26 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D27 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D28 | DI ZEN BZX79C8V2 8.2V 5% | 28371-671E | K8996 | BZX79 C8V2 |
| D29 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D30 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D31 | DI H/CARR HP5082-2080 .34V SET ! | 28349-012Y | K3464 | HP5082 2080 |
| D35 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D38 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D39 | DI ZEN BZX79C7V5 7.5V 5% | 28371-602Z | K8996 | BZX79 C7V5 |
| D40 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AB1/1 - D - A Converter** | | | (Contd.) | | |
| D42 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D43 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| IC1 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC2 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC3 | ICA DAC 80-CBI-I 12BIT | | 28541-011L | K7284 | AD DAC 80D-CBI-I |
| IC4 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC5 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC6 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC7 | ICD CTR 74LS191 4BIT BIN U/D | | 28464-022X | K5519 | SN74LS191N |
| IC8 | ICD CTR 74LS191 4BIT BIN U/D | | 28464-022X | K5519 | SN74LS191N |
| IC9 | ICD CTR 74LS191 4BIT BIN U/D | | 28464-022X | K5519 | SN74LS191N |
| IC10 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC11 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC12 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC13 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC14 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC15 | ICA SW SD5002 QUAD DMOS 7.5V | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC16 | ICA SW SD5002 QUAD DMOS 7.5V | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC17 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC18 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC19 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC20 | ICA SW SD5002 QUAD DMOS 7.5V | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC21 | ICA AMP TL071CP FET I/P DIL8 | | 28461-347A | K5519 | TL071CP |
| IC22 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC23 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC24 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC25 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC26 | ICA AMP LM358N DUAL GP DIL8 | | 28461-342M | K5519 | MLM358PIORLM358N |
| IC27 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC28 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC29 | ICA DAC DAC08CQ 8BIT FAST MULT | | 28469-395B | 06665 | DAC-08CQ |
| IC30 | ICA DAC DAC08CQ 8BIT FAST MULT | | 28469-395B | 06665 | DAC-08CQ |
| IC31 | ICA DAC DAC08CQ 8BIT FAST MULT | | 28469-395B | 06665 | DAC-08CQ |
| IC32 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC33 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC34 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC35 | ICA VREF REF-02EJ 5V TO99 | | 28461-920W | U3418 | REF 02ET |
| IC36 | ICA DAC AD7524JN 8BIT | ! | 28469-400R | K7284 | AD7524JN OR AD |
| IC37 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC38 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC39 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC40 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AB1/1** | **- D - A Converter** | | (Contd.) | | |
| IC41 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC42 | ICA AMP LM348N QUAD GP DIL14 | | 28461-321E | K5519 | LM348N |
| IC43 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC44 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC45 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC46 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC47 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC48 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC49 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC50 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC51 | ICA SW DG212CJ QUAD CMOS | ! | 28461-967H | | |
| IC52 | ICA COMP LM339N QUAD | | 28461-693H | K5519 | LM339N |
| IC53 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC54 | ICD BUFF 74LS244 OCT 3ST | | 28469-182T | K5519 | SN74LS244N |
| IC55 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC56 | ICA DAC 888FX 8BIT LATCHED I/P | | 28469-434K | 06665 | DAC-888FX OR EX |
| IC57 | ICA AMP NE5534AN H-PRF DIL8 | | 28461-358J | K0461 | NE5534AP |
| IC58 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| IC59 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| IC60 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| IC61 | ICA AMP LF357N FET I/P LN DIL8 | | 28461-356N | K7093 | LF357N |
| L1 | IND RF 320uH | | 44190-038A | U2632 | 44190-038A |
| L2 | IND CHOKE 68UH 10% LAQ | | 23642-560S | U4038 | SC10 35 |
| PLD | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLE | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLH | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLJ | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLK | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLL | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLM | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAE | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAH | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAJ | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAK | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1 - D - A Converter** | | (Contd.) | | |
| PLAY | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLSD | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLTA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLTB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLTC | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLTD | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLTE | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLTF | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R2 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R3 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R4 | RES MF 51K .25W 2% 100PPM | 24773-314E | K8996 | MR25 |
| R5 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R6 | RES MF 10K0 .25W .1% 50PPM | 24723-405W | K8479 | H8 |
| R7 | RES MF 4K99 .25W .1% 50PPM | 24723-406D | K8479 | H8 |
| R8 | RES MF 1K0 .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R9 | RES MF 1K5 .25W 0.1% 50PPM | 24723-302S | K8479 | H8 |
| R10 | RES MF 499R .25W .1% 50PPM | 24723-408P | K8479 | H8 |
| R11 | RES MF 1K0 .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R12 | RES MF 499R .25W .1% 50PPM | 24723-408P | K8479 | H8 |
| R13 | RES MF 499R .25W .1% 50PPM | 24723-408P | K8479 | H8 |
| R14 | RES MF 20R .25W 2% 100PPM | 24773-232X | K8996 | MR25 |
| R15 | RES MF 16K .25W 2% 100PPM | 24773-302X | K8996 | MR25 |
| R16 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R17 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R18 | RN ISOL 220K 2% 16DIL | 24681-505W | U4736 | 761 3 |
| R19 | RN ISOL 220K 2% 16DIL | 24681-505W | U4736 | 761 3 |
| R20 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R21 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R22 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R23 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R24 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R25 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R26 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R27 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R28 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R29 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R30 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R31 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R32 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R33 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R34 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R35 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1** | **- D - A Converter** | (Contd.) | | |
| R36 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R37 | RN ISOL 20K 0.5% 16DIL | 24681-518A | KO718 | 698 3 R20K-D |
| R38 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R39 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R40 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R41 | RES MF 430R .25W 2% 100PPM | 24773-264X | K8996 | MR25 |
| R42 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R43 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R44 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R45 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R46 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R47 | RES MF 5KO .25W .1% 50PPM | 24723-401F | K8479 | H8 |
| R48 | RES MF 320K .25W .1% 50PPM | 24723-404S | K8479 | H8 |
| R49 | RES MF 5KO .25W .1% 50PPM | 24723-401F | K8479 | H8 |
| R50 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R51 | RES MF 320K .25W .1% 50PPM | 24723-404S | K8479 | H8 |
| R52 | RES MF 5KO .25W .1% 50PPM | 24723-401F | K8479 | H8 |
| R53 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R54 | RES MF 2KO .25W .1% 50PPM | 24723-402G | K8479 | H8 |
| R55 | RES MF 2KO .25W .1% 50PPM | 24723-402G | K8479 | H8 |
| R56 | RES MF 2KO .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R57 | RES MF 1KO .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R58 | RES MF 1KO .25W .1% 50PPM | 24723-403V | K8479 | H8 |
| R59 | RES MF 2KO .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R60 | RES MF 1KO .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R61 | RES MF 1MO .125W 2% 100PPM | 24772-141T | U0142 | CMF51 |
| R62 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R63 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R64 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R65 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R66 | RES MF 20KO .25W 0.5% 50PPM | 24753-663N | K8479 | H8 |
| R67 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R68 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R69 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R70 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R71 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R72 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R73 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R74 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R75 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R76 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R77 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1 - D - A Converter** | | (Contd.) | | |
| R78 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R79 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R80 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R81 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R82 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R83 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R84 | RV CERM 2K0 LI .5W 10% | 25711-639V | U0914 | E2A |
| R85 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R86 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R87 | RES MF 3K0 .125W 2% 100PPM | 24772-084H | U0142 | CMF51 |
| R89 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R90 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R91 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R92 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R93 | RES MF 36K .125W 2% 100PPM | 24772-110P | U0142 | CMF51 |
| R94 | RES MF 910R .125W 2% 100PPM | 24772-072P | U0142 | CMF51 |
| R95 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R96 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R97 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R98 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R99 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R100 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R101 | RES MF 3K9 .125W 2% 100PPM | 24772-087Y | U0142 | CMF51 |
| R102 | RES MF 3K9 .125W 2% 100PPM | 24772-087Y | U0142 | CMF51 |
| R103 | RES MF 75K .25W 2% 100PPM | 24773-318L | K8996 | MR25 |
| R105 | RES MF 30K .125W 2% 100PPM | 24772-108X | U0142 | CMF51 |
| R106 | RES MF 150K .125W 2% 100PPM | 24772-125Y | U0142 | CMF51 |
| R107 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R108 | RES MF 30K .125W 2% 100PPM | 24772-108X | U0142 | CMF51 |
| R109 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R110 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R111 | RES MF 13K .125W 2% 100PPM | 24772-100F | U0142 | CMF51 |
| R112 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R113 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R114 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R115 | RES MF 270K .25W 2% 100PPM | 24773-331D | K8996 | MR25 |
| R118 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R119 | RES MF 3K9 .125W 2% 100PPM | 24772-087Y | U0142 | CMF51 |
| R120 | RES MF 3K9 .125W 2% 100PPM | 24772-087Y | U0142 | CMF51 |
| R121 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R122 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R123 | RES MF 7K5 .25W 2% 100PPM | 24773-294T | K8996 | MR25 |
| R124 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1 - D - A Converter** | | (Contd.) | | |
| R126 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R128 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R129 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R130 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R131 | RES MF 3KO .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R132 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R133 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R134 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R135 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R136 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R137 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R138 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R139 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R140 | RES MF 62K .125W 2% 100PPM | 24772-116K | U0142 | CMF51 |
| R141 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R142 | RV CERM 50K LI .5W 10% | 25711-643S | U0914 | E2A |
| R143 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R146 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R147 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R148 | RES MF 7R5 .25W 2% 100PPM | 24773-222G | U1395 | RC55 |
| R149 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R150 | RES MF 1K2 .125W 2% 100PPM | 24772-075C | U0142 | CMF51 |
| R151 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R152 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R156 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R157 | RES MF 3KO .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R158 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R159 | RES MF 130K .25W 2% 100PPM | 24773-324G | K8996 | MR25 |
| R160 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R161 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R162 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R163 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R164 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R165 | RES MF 1RO .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R166 | RES MF 1RO .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R167 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R168 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R169 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R170 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R171 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R172 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R173 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| Board AB1/1 | - D - A Converter | | (Contd.) | |
| R174 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R175 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R176 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R177 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R178 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R179 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R180 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R181 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R182 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R183 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R184 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R185 | RES MF 39R .25W 2% 100PPM | 24773-239Z | K8996 | MR25 |
| R186 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R187 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R188 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R189 | RES MF 82K .25W 2% 100PPM | 24773-319J | K8996 | MR25 |
| R190 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R191 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R192 | RES MF 2R4 .25W 2% 100PPM | 24773-210Z | U1395 | RC55 |
| R193 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R194 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R195 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R196 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R197 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R200 | RES MF 9K1 .125W 2% 100PPM | 24772-096V | U0142 | CMF51 |
| R201 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R202 | RES MF 36K .25W 2% 100PPM | 24773-310K | K8996 | MR25 |
| R210 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R211 | RES MF 30K .125W 2% 100PPM | 24772-108X | U0142 | CMF51 |
| R212 | RES MF 510R .125W 2% 100PPM | 24772-066W | U0142 | CMF51 |
| R213 | RES MF 510R .125W 2% 100PPM | 24772-066W | U0142 | CMF51 |
| R214 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R215 | RES MF 1K0 .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R216 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R217 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| R218 | RES MF 100K .125W 2% 100PPM | 24772-121Z | U0142 | CMF51 |
| SA | SW SLIDE 7NO 25V DIL | 23467-311R | U4736 | 206 007 |
| TR1 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR2 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR3 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR4 | TR PSI BC307A 45V 130M - GEN | 28435-227H | K6360 | BC307A |
| TR5 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB1/1 - D - A Converter** | | (Contd.) | | |
| TR6 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR7 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR8 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR9 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR10 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR11 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR12 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR13 | TR NJF J310 25V - 24MA | 28459-028E | K5519 | J310 |
| TR14 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR15 | TR NJF J310 25V - 24MA | 28459-028E | K5519 | J310 |
| TR16 | TR NJF 2N4858 40V - 8MA SW | 28459-037F | | |
| TR17 | TR PSI BC307A 45V 130M - GEN | 28435-227H | K6360 | BC307A |
| TR18 | TR PSI BC450 100V 200M | 28438-259F | K5519 | BC450 |
| TR19 | TR NSI TIP112 100V 5M DAR | 28457-822L | K5519 | TIP112 |
| TR20 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR21 | TR NSI BC449 100V 250M | 28457-821N | K5519 | BC449 |
| TR22 | TR PSI 2N2905A 60V 200M - GEN | 28435-868C | K6617 | 2N2905A |
| TR23 | TR PSI 2N2905A 60V 200M - GEN | 28435-868C | K6617 | 2N2905A |
| TR24 | TR NSI 2N2219A 40V 300M - GEN | 28454-804V | K5519 | 2N2219A |
| TR25 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR26 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR27 | TR NJF 2N4856 40V 25R 50MA | 28459-050P | K8996 | 2N4856 |
| TR30 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR31 | TR NMF VN10KM 60V 5RO - VMOS ! | 28459-046T | U5008 | VN 10 KM |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB2** | **- Interpolation Oscillator** | | | |
| 27. When ordering, prefix circuit reference with AB2 | | | | |
| | Complete unit | 44828-537C | U2632 | 44828-537C |
| C1 | CAP MICA 15P 350V 1PF | 26272-020F | K8300 | CODE23 ORCODE250 |
| C2 | CAP CER 18P 500V 5% | 26343-060Y | K6791 | GEU605 |
| C3 | CAP CER 18P 500V 5% | 26343-060Y | K6791 | GEU605 |
| C4 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C5 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C6 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C7 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C8 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C11 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C12 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C13 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C14 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C15 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C16 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C19 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C20 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C21 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C22 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C29 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C30 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C31 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C32 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C33 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C34 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C35 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C36 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C37 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| D1 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D2 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D3 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D4 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D6 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D8 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D9 | DI H/CARR BAT42 30V FAST ! | 28349-013N | K6791 | BAT 42 |
| IC1 | ICA VREG UA723C ADJ DIL14 | 28461-706F | K0461 | UA723CN |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB2** | **- Interpolation Oscillator** | | (Contd.) | |
| IC2 | ICA VREG+ 78L05AC 5V .1A TO92 | 28461-734Y | K0461 | UA78L05AC |
| L3 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| L4 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| L5 | CHOKE ASSY | 44190-034C | U2632 | 44190-034C |
| L6 | CHOKE ASSY | 44190-034C | U2632 | 44190-034C |
| PLN | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLP | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLR | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLS | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R2 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R3 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R4 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R5 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R6 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R7 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R8 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R9 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R10 | RES MF 18K0 .25W 0.1% 25PPM | 24723-413M | K8479 | H8 |
| R11 | RES MF 2K0 .25W .1% 50PPM | 24723-402G | K8479 | H8 |
| R12 | RES MF 200R .25W .1% 25PPM | 24723-396G | K8479 | H8 |
| R13 | RES MF 2K4 .125W 2% 100PPM | 24772-082A | U0142 | CMF51 |
| R14 | RES MF 2K4 .125W 2% 100PPM | 24772-082A | U0142 | CMF51 |
| R15 | RES CC 56R .125W 5% | 24331-944N | U0914 | BB5605 |
| R16 | RES MF 160R .125W 2% 100PPM | 24772-054U | U0142 | CMF51 |
| R17 | RES CC 820R .125W 5% | 24331-993X | U0914 | BB8215 |
| R18 | RES MF 390R .125W 2% 100PPM | 24772-063G | U0142 | CMF51 |
| R19 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R20 | RES CC 36R .125W 5% | 24331-936Z | U0914 | BB3605 |
| R21 | RES CC 100R .125W 5% | 24331-997B | U0914 | BB1015 |
| R22 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R23 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R24 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R25 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R32 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R33 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R34 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R35 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R40 | RES MF 8K2 .125W 2% 100PPM | 24772-095G | U0142 | CMF51 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB2** | **- Interpolation Oscillator** | (Contd.) | | |
| R41 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R42 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R43 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R44 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R45 | RES MF 2R2 .25W 2% 100PPM | 24773-209E | U1395 | RC55 |
| R46 | RES MF 2R2 .25W 2% 100PPM | 24773-209E | U1395 | RC55 |
| R47 | RES MF 1K8 .25W .1% 25PPM | 24723-395F | K8479 | H8 |
| TR1 | TR NJF J310 25V - 24MA | 28459-028E | K5519 | J310 |
| TR2 | TR NJF 2N4857 40V 40R 20MA | 28459-051X | K8996 | 2N4857 |
| TR3 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR4 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR5 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR6 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR7 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| T1 | OSC TRANS ASSY | 43590-120W | U2632 | 43590-120W |
| T2 | MATCHING TRANS ASSY | 43590-127R | U2632 | 43590-127R |
| T3 | SPLITTER TRANS ASSY | 43590-123P | U2632 | 43590-123P |
| T4 | BUFFER O/P TRANS ASSY | 43590-122T | U2632 | 43590-122T |
| T5 | BUFFER O/P TRANS ASSY | 43590-122T | U2632 | 43590-122T |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB3** | **- Master VCO** | | | |
| 28. When ordering, prefix circuit reference with AB3 | | | | |
| | Complete unit | 44828-464P | U2632 | 44828-464P |
| C1 | CAP MICA 33P 350V 1PF | 26272-391L | K8300 | CODE23 ORCODE250 |
| C2 | CAP PS 15P 63V 1PF | 26538-506K | K4642 | EXFS RP1 |
| C3 | CAP PS 15P 63V 1PF | 26538-506K | K4642 | EXFS RP1 |
| C4 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C5 | CAP PS 150P 63V 2% | 26538-571R | K4642 | EXFS RP1 |
| C7 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C8 | CAP CER 330P 63V 2% | 26343-483D | K6617 | EDPU |
| C9 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C11 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C12 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C13 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C14 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C15 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C16 | CAP CER 39P 63V 2% | 26343-472N | K8996 | 2222 682 |
| C19 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C20 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C21 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C22 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C29 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C30 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C31 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C32 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C33 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C34 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C35 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C36 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C37 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C38 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C39 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C40 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C41 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C42 | CAP PETP 470N 63V 10% | 26582-402V | | |
| C43 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C47 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| D1 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D2 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D3 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D4 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB3** | **- Master VCO** | | (Contd.) | |
| D6 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D7 | DI ZEN BZX79C20 20V 5% | 28372-785K | K8996 | BZX79 C20 |
| IC1 | ICA VREG UA723C PROG DIL14 | 28461-706F | K0461 | UA723CN |
| IC2 | ICA AMP TL072CP DUAL FET I/P | 28461-348Z | K5519 | TL072CP |
| L1 | OSC COIL ASSY | 44290-870V | U2632 | 44290-870V |
| L4 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| L5 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| L6 | CHOKE ASSY | 44190-034C | U2632 | 44190-034C |
| L7 | CHOKE ASSY | 44190-034C | U2632 | 44190-034C |
| L8 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| R1 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R2 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R3 | RES MF 3K9 .25W 2% 100PPM | 24773-287V | K8996 | MR25 |
| R5 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R6 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R7 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R8 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R12 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R13 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R14 | RES MF 56R .25W 2% 100PPM | 24773-243H | K8996 | MR25 |
| R15 | RES MF 160R .25W 2% 100PPM | 24773-254G | K8996 | MR25 |
| R16 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R17 | RES MF 390R .125W 2% 100PPM | 24772-063G | U0142 | CMF51 |
| R18 | RES CC 200R .125W 5% | 24331-999A | U0914 | BB2015 |
| R19 | RES MF 36R .25W 2% 100PPM | 24773-238A | K8996 | MR25 |
| R20 | RES CC 100R .125W 5% | 24331-997B | U0914 | BB1015 |
| R21 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R22 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R23 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R24 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R31 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R32 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R33 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R34 | RES CC 10R .125W 5% | 24331-974U | U0914 | BB1005 |
| R35 | RES MF 43R .25W 2% 100PPM | 24773-240K | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB3** | **- Master VCO** | (Contd.) | | |
| R36 | RES MF 82R .25W 2% 100PPM | 24773-247N | K8996 | MR25 |
| R37 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R40 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R41 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R42 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R43 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R44 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R45 | RES MF 2R2 .25W 2% 100PPM | 24773-209E | U1395 | RC55 |
| R46 | RES MF 2R2 .25W 2% 100PPM | 24773-209E | U1395 | RC55 |
| R47 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R50 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R52 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R53 | RES MF 2K2 .25W 2% 100PPM | 24773-281Y | K8996 | MR25 |
| R54 | RES MF 390R .25W 2% 100PPM | 24773-263P | K8996 | MR25 |
| R56 | RES MF 390R .25W 2% 100PPM | 24773-263P | K8996 | MR25 |
| R57 | RES MF 24K .25W 2% 100PPM | 24773-306B | K8996 | MR25 |
| R58 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R60 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R61 | RES CC 100R .125W 5% | 24331-997B | U0914 | BB1015 |
| TR1 | TR NJF J310 25V - 24MA | 28459-028E | K5519 | J310 |
| TR3 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR4 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR5 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR6 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR7 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR8 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR9 | TR NJF 2N4857 40V 40R 20MA | 28459-051X | K8996 | 2N4857 |
| T1 | MATCHING TRANS ASSY | 43590-127R | U2632 | 43590-127R |
| T2 | SPLITTER TRANS ASSY | 43590-123P | U2632 | 43590-123P |
| T3 | BUFFER O/P TRANS ASSY | 43590-122T | U2632 | 43590-122T |
| T4 | BUFFER O/P TRANS ASSY | 43590-122T | U2632 | 43590-122T |
| T5 | O/P BALUN | 43590-147V | U2632 | 43590-147V |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AB4** | **- Sampling gate** | | | | |
| 29. When ordering, prefix circuit reference with AB4 | | | | | |
| | Complete unit | | 44828-465X | U2632 | 44828-465X |
| C1 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C2 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C3 | CAP TANT 2U2 35V 20% | | 26486-214V | U3613 | SH |
| C4 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C5 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C6 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C7 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C8 | CAP CER 27P 63V 2% | | 26343-470U | K8996 | 2222 682 |
| C9 | CAP CER 6P8 63V .5PF | | 26343-463A | K8996 | 2222 682 |
| C10 | CAP CER 68P 63V 2% | | 26343-475F | K8996 | 2222 682 |
| C11 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C12 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C13 | CAP TANT 2U2 35V 20% | | 26486-214V | U3613 | SH |
| C14 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C15 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C16 | CAP CER 220P 63V 2% | | 26343-481S | K8996 | 2222 682 |
| C17 | CAP CER 6P8 63V .5PF | | 26343-463A | K8996 | 2222 682 |
| C18 | CAP PETP 220N 63V 10% | | 26582-406T | K8283 | M2B22101B |
| C19 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C20 | CAP CER 10N 50V 20% X7R MON | AX | 26346-120Y | U2109 | MA10 5C103 MAA |
| C21 | CAP CER 10N 50V 20% X7R MON | AX | 26346-120Y | U2109 | MA10 5C103 MAA |
| C22 | CAP CER 10N 50V 20% X7R MON | AX | 26346-120Y | U2109 | MA10 5C103 MAA |
| C23 | CAP ELEC 470U 6V 20%+ | | 26421-126S | U4011 | CEB4706 |
| C24 | CAP ELEC 1000U 10V 20%+ | | 26415-824S | U2475 | SLT1000/10 |
| C25 | CAP ELEC 100U 6.3V 20% | | 26421-118L | U4011 | K100/6.3 |
| D1 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D2 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D3 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D4 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D5 | DI ZEN BZX79C5V6 5.6V 5% | | 28371-417X | K8996 | BZX79 C5V6 |
| D6 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D8 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D9 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D10 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D11 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D12 | DI ZEN BZX79C5V6 5.6V 5% | | 28371-417X | K8996 | BZX79 C5V6 |
| D13 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB4** | **- Sampling gate** | | (Contd.) | |
| IC1 | ICA AMP TL071CP FET I/P DIL8 | 28461-347A | K5519 | TL071CP |
| IC2 | ICA AMP TL071CP FET I/P DIL8 | 28461-347A | K5519 | TL071CP |
| IC3 | ICA AMP UA741CN GP DIL8 | 28461-304T | K5519 | MC1741CP |
| IC4 | ICD CTR 10138 4BIT DEC | 28464-019X | K5519 | MC10138P |
| IC5 | ICD CTR 10138 4BIT DEC | 28464-019X | K5519 | MC10138P |
| IC6 | ICD CTR 10138 4BIT DEC | 28464-019X | K5519 | MC10138P |
| L1 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| L2 | IND CHOKE 1.0UH 10% LAQ | 23642-549L | U4038 | SC10 13 |
| R1 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R2 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R3 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R4 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R5 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R6 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R7 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R8 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R9 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R10 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R11 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R12 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R13 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R14 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R15 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R16 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R17 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R18 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R19 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R20 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R21 | RV CERM 10K LI .5W 10% | 25711-641G | U0914 | E2A |
| R22 | RES MF 680R .25W 2% 100PPM | 24773-269K | K8996 | MR25 |
| R23 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R24 | RES MF 2KO .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R25 | RES MF 360R .25W 2% 100PPM | 24773-262T | K8996 | MR25 |
| R26 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R27 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R28 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R29 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R30 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB4** | **- Sampling gate** (Contd.) | | | |
| R31 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R32 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R33 | RES MF 390R .25W 2% 100PPM | 24773-263P | K8996 | MR25 |
| R34 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R35 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R36 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R37 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R38 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R39 | RES MF 20R .25W 2% 100PPM | 24773-232X | K8996 | MR25 |
| R40 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R41 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R42 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R43 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R44 | RES MF 20R .25W 2% 100PPM | 24773-232X | K8996 | MR25 |
| R45 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R46 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R47 | RES MF 62R .25W 2% 100PPM | 24773-244E | K8996 | MR25 |
| R48 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R49 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| TR1 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR2 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR3 | TR NSI BC208B 20V 150M - GEN | 28452-781A | K1196 | ZTX108BL |
| TR4 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR5 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR6 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR7 | TR NSI BC208B 20V 150M - GEN | 28452-781A | K1196 | ZTX108BL |
| TR8 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR9 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| T1 | BALUN ASSY | 43590-125M | U2632 | 43590-125M |
| T2 | UNBAL ASSY | 43590-166Z | | |
| T3 | BALUN ASSY | 43590-125M | U2632 | 43590-125M |
| T4 | UNBAL ASSY | 43590-166Z | | |
| T5 | UNBAL ASSY | 43590-166Z | | |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB5** | **- Slave VCO** | | | |
| 30. When ordering, prefix circuit reference with AB5 | | | | |
| | Complete unit | 44828-466M | U2632 | 44828-466M |
| C1 | CAP MICA 33P 350V 1PF | 26272-391L | K8300 | CODE23 ORCODE250 |
| C2 | CAP PS 33P 63V 1PF | 26538-530D | K4642 | EXFS RP1 |
| C3 | CAP PS 33P 63V 1PF | 26538-530D | K4642 | EXFS RP1 |
| C4 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C5 | CAP PS 120P 63V 2% | 26538-565X | K4642 | EXFS RP 1 |
| C6 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C7 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C11 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C12 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C13 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C14 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C15 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C16 | CAP CER 39P 63V 5% | 26343-472N | K8996 | 2222 682 |
| C19 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C20 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C21 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C22 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C29 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C30 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C31 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C32 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C33 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C34 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C35 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C36 | CAP PETP 1U0 50V 10% | 26582-432F | K1945 | R68 C C 1004 AAK |
| C37 | CAP CER 33P 63V 5% | 26343-471Y | K8996 | 2222 682 |
| C38 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C39 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| D1 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D2 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D3 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D4 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| IC1 | ICA AMP NE5534AN H-PRF DIL8 | 28461-358J | K0461 | NE5534AP |
| L1 | OSC COIL ASSY | 44290-870V | U2632 | 44290-870V |
| L3 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| L4 | IND CHOKE 4.7UH 10% LAQ | 23642-553J | U4038 | SC10 21 |
| L5 | CHOKE ASSY | 44190-034C | U2632 | 44190-034C |
| L6 | CHOKE ASSY | 44190-034C | U2632 | 44190-034C |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB5** | **- Slave VCO** | (Contd.) | | |
| R1 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R2 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R3 | RES MF 3K9 .25W 2% 100PPM | 24773-287V | K8996 | MR25 |
| R4 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R5 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R6 | RES MF 3K9 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R12 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R13 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R14 | RES MF 56R .25W 2% 100PPM | 24773-243H | K8996 | MR25 |
| R15 | RES MF 160R .25W 2% 100PPM | 24773-254G | K8996 | MR25 |
| R16 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R17 | RES MF 390R .25W 2% 100PPM | 24773-263P | K8996 | MR25 |
| R18 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R19 | RES MF 36R .25W 2% 100PPM | 24773-238A | K8996 | MR25 |
| R20 | RES CC 100R .125W 5% | 24331-997B | U0914 | BB1015 |
| R21 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R22 | RES MF 270R .125W 2% 100PPM | 24772-059F | U0142 | CMF51 |
| R23 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R24 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R31 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R32 | RES MF 270R .125W 2% 100PPM | 24772-057F | U0142 | CMF51 |
| R33 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R34 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R45 | RES MF 2R2 .25W 2% 100PPM | 24773-209E | U1395 | RC55 |
| R46 | RES MF 2R2 .25W 2% 100PPM | 24773-209E | U1395 | RC55 |
| R47 | RES MF 2R2 .25W 2% 100PPM | 24773-209E | U1395 | RC55 |
| R51 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R52 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R53 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R54 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R55 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R57 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| TR1 | TR NJF J310 25V - 24MA | 28459-028E | K5519 | J310 |
| TR3 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR4 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR5 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR6 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB5** | **- Slave VCO** | | (Contd.) | |
| T1 | MATCHING TRANS ASSY | 43590-127R | U2632 | 43590-127R |
| T2 | SPLITTER TRANS ASSY | 43590-123P | U2632 | 43590-123P |
| T3 | BUFFER O/P TRANS ASSY | 43590-122T | U2632 | 43590-122T |
| T4 | BUFFER O/P TRANS ASSY | 43590-122T | U2632 | 43590-122T |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB6** | **- Phase detector** | | | |
| 31. When ordering, prefix circuit reference with AB6 | | | | |
| | Complete unit | 44828-467C | U2632 | 44828-467C |
| C1 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C2 | CAP CER 10N 50V 20% X7R MON AX | 26346-120Y | U2109 | MA10 5C103 MAA |
| C3 | CAP CER 10N 50V 20% X7R MON AX | 26346-120Y | U2109 | MA10 5C103 MAA |
| C4 | CAP CER 10N 50V 20% X7R MON AX | 26346-120Y | U2109 | MA10 5C103 MAA |
| C5 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C6 | CAP CER 220P 63V 2% | 26343-481S | K8996 | 2222 682 |
| C9 | CAP PETP 100N 100V 10% | 26582-211B | K8300 | PMT2R OR PMC2R |
| C10 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C11 | CAP PETP 100N 100V 10% | 26582-211B | K8300 | PMT2R OR PMC2R |
| C12 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C13 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C14 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C20 | CAP CER 4N7 63V 2% | 26343-591B | K8996 | 2222 682 |
| C21 | CAP ELEC 2U2 50V 20% | 26421-009E | U2475 | LRVB 2.2/50M |
| D1 | LAMP LED TIL209 3V RED | 28624-110P | K0461 | TIL209 OR TIL216 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| IC1 | ICD CTR 74LS93 4BIT BIN 2,8,16 | 28464-117W | K5519 | SN74LS93N |
| IC2 | ICD NAND 74LS00 QUAD 2INP | 28466-345H | K5519 | SN74LS00N |
| IC3 | ICD FF-D 74HCT74 +EDG TR | 28462-611A | K5519 | SN74LS74AN |
| IC4 | ICA SW SD5002 QUAD DMOS ! | 28469-717Y | K7068 | SD5002N OR I |
| IC5 | ICA AMP TL074CN QUAD FET I/P | 28461-349H | K5519 | TL074CN |
| L1 | IND CHOKE 40UH | 44190-036B | U2632 | 44190-036B |
| R1 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R2 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R3 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R4 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R5 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R6 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R7 | RES MF 15R .25W 2% 100PPM | 24773-229X | K8996 | MR25 |
| R8 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R9 | RES MF 910R .25W 2% 100PPM | 24773-272K | K8996 | MR25 |
| R10 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB6** | **- Phase detector** (Contd.) | | | |
| R11 | RES MF 33R .25W 2% 100PPM | 24773-237K | K8996 | MR25 |
| R12 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R13 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R14 | RES MF 1K3 .25W 2% 100PPM | 24773-276E | K8996 | MR25 |
| R15 | RES MF 150K .25W 2% 100PPM | 24773-325V | K8996 | MR25 |
| R16 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R17 | RES MF 820K .25W 2% 100PPM | 24773-344Z | U2453 | LR1 OR PR1 |
| R18 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R19 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R20 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R21 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R22 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R23 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R24 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R25 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R26 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R27 | RES MF 2K2 .25W 2% 100PPM | 24773-281Y | K8996 | MR25 |
| R28 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R29 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R30 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R31 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R32 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| TR1 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR2 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR3 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR4 | TR NJF 2N4857 40V 40R 20MA | 28459-051X | K8996 | 2N4857 |
| TR5 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR6 | TR NJF 2N4857 40V 40R 20MA | 28459-051X | K8996 | 2N4857 |
| T1 | BALUN TRANS ASSY | 43590-167H | | |
| T2 | BALUN TRANS ASSY | 43590-167H | | |
| X1 | MOD RF SBL-1 DOUBLE BAL MIXER | 28531-002A | 15542 | SBL-1 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB7** | **- Oscillator Select** | | | |
| 32. When ordering, prefix circuit reference with AB7 | | | | |
| | Complete unit | 44828-538R | U2632 | 44828-538R |
| C1 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C2 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C3 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C4 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C5 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C6 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C7 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C8 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C9 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C10 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C11 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C12 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C13 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C14 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| IC1 | ICD OR 74LS32 QUAD 2INP | 28466-108U | K5519 | SN74LS32N |
| IC2 | ICD NAND 74S10 TRIP 3INP | 28466-338B | K0461 | SN74S10N |
| PLAA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAC | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R2 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R3 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R5 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R6 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R7 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R8 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R9 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R10 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R11 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R12 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R14 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R15 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R16 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R17 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB7** | **- Oscillator Select** | (Contd.) | | |
| R18 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R19 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| TR1 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |
| TR2 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR3 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |
| TR4 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR5 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |
| TR6 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR7 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AB8** | **- Attenuator Control** | | | | |
| 33. When ordering, prefix circuit reference with AB8 | | | | | |
| | Complete unit | | 44828-543K | U2632 | 44828-543K |
| C1 | CAP PETP 220N 63V 10% | | 26582-430L | K1945 | R68 D C 2203 AAK |
| C2 | CAP PETP 220N 63V 10% | | 26582-430L | K1945 | R68 D C 2203 AAK |
| C3 | CAP TANT 1U0 35V 20% | | 26486-209F | U3613 | SH |
| C4 | CAP TANT 1U0 35V 20% | | 26486-209F | U3613 | SH |
| C5 | CAP ELEC 10U 35V 20% | | 26421-112Z | U4011 | K10/35 |
| C6 | CAP ELEC 470U 16V 20%+ | | 26421-127W | U4011 | CEB47016 |
| C7 | CAP ELEC 470U 16V 20%+ | | 26421-127W | U4011 | CEB47016 |
| C8 | CAP CER 56P 63V 2% | | 26343-444G | | |
| D1 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D4 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D5 | DI ZEN BZX79C5V6 5.6V 5% | | 28371-417X | K8996 | BZX79 C5V6 |
| D6 | DI RECT 11DQ04 40V SCHOTTKY | | 28355-170U | U5008 | 11DQ04 |
| D7 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D8 | LAMP LED HLMP1301 2.4V RED | | 28624-136W | K3464 | HLMP1301 |
| IC1 | ICD BUFF 74HCT365 HEX 3ST | ! | 28469-148P | K8996 | PC74HCT365P |
| IC2 | ICD BUFF 74HCT366 HEX 3ST INV | ! | 28469-149X | K8996 | PC74HCT366P |
| IC3 | ICD NAND 74LS00 QUAD 2INP | | 28466-345H | K5519 | SN74LS00N |
| IC4 | ICD INV 74LS04 HEX | | 28469-171L | K5519 | SN74LS04N |
| IC5 | ICD NAND 74LS00 QUAD 2INP | | 28466-345H | K5519 | SN74LS00N |
| IC6 | ICD MONO 74LS123 DUAL RETR | | 28468-309B | K5519 | SN74LS123N |
| IC7 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC8 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC9 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC10 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| MP1 | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| MP2 | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| MP3 | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| MP4 | CON JUMP FEM 2 9.6MM | | 23435-990X | U2338 | 65474 001 |
| PLAR | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAS | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAT | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAU | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAV | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLTJ | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AB8** | **- Attenuator Control** | (Contd.) | | |
| R1 | RN ISOL 330R 2% 16DIL | 24681-513M | U4736 | 761 3 |
| R2 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R3 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R4 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R5 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R6 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R7 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R8 | RES MF 56K .125W 2% 100PPM | 24772-115B | U0142 | CMF51 |
| R9 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R10 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R11 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R12 | RN ISOL 100K 2% 16DIL | 24681-512X | U4736 | 761 3 |
| R13 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R14 | RES MF 200K .25W 2% 100PPM | 24773-328D | K8996 | MR25 |
| R15 | RV CERM 2K0 LI .5W 10% | 25711-639V | U0914 | E2A |
| R16 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R17 | RES MF 270K .25W 2% 100PPM | 24773-331D | K8996 | MR25 |
| R18 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R19 | RV CERM 2K0 LI .5W 10% | 25711-639V | U0914 | E2A |
| R20 | RES MF 200K .25W 2% 100PPM | 24773-328D | K8996 | MR25 |
| R21 | RES MF 270K .25W 2% 100PPM | 24773-331D | K8996 | MR25 |
| R22 | RES MF 360R .25W 2% 100PPM | 24773-262T | K8996 | MR25 |
| R23 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R24 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R25 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R26 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R27 | RES MF 270K .25W 2% 100PPM | 24773-331D | K8996 | MR25 |
| TR1 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR2 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR3 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR4 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR5 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR6 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR7 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR8 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR9 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR10 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR11 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR12 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR13 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR14 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |
| TR15 | TR PSI ZTX750K 45V 100M 1W | 28435-226Z | K1196 | ZTX750K |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AC0/AD0 - IF Box Assembly (AC/AD)** | | | | |
| 34. When ordering, prefix circuit reference with AC0/AD0 | | | | |
| | Complete unit | 44990-663D | U2632 | 44990-663D |
| C2 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C3 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C4 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C5 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C6 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C7 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C8 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C9 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C10 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C11 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C12 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C13 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C14 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C15 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C16 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C17 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C18 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C19 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C20 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C21 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C22 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C23 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C24 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C25 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C26 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C27 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C28 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C29 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C33 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C34 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C35 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C36 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C37 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C38 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C39 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C40 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C41 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AC0/AD0** | **- IF Box Assembly (AC/AD)** (Contd.) | | | |
| C42 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C43 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C44 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C45 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C46 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C47 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C48 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C49 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C50 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C51 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C52 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C53 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C56 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C57 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C58 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C59 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C60 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C61 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C62 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C63 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C64 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C65 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C66 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C67 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C68 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C69 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C70 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C71 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C72 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C73 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C74 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C75 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C76 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C80 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C81 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C83 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| IC1 | ICA VREG+ 78L05AC 5V .1A TO92 | 28461-734Y | K0461 | UA78L05AC |
| IC2 | ICA VREG- 79L12AC 12V .1A TO92 | 28461-737J | K5519 | MC79L12AC |
| L1 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L2 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L3 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L4 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AC0/AD0 - IF Box Assembly (AC/AD)** | | (Contd.) | | |
| L5 | IND LF 1MH PWR | 44190-042Z | U2632 | 44190-042Z |
| L8 | IND | 34900-918Y | U2632 | 34900-918Y |
| L9 | IND CHOKE 680UH 10% LAQ | 23642-566M | U4038 | SC10 47 |
| L10 | IND CHOKE 680UH 10% LAQ | 23642-566M | U4038 | SC10 47 |
| L11 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L12 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L13 | IND CHOKE 680UH 10% LAQ | 23642-566M | U4038 | SC10 47 |
| L14 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L15 | IND LF 1MH PWR | 44190-042Z | U2632 | 44190-042Z |
| L16 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L17 | IND CHOKE 680UH 10% LAQ | 23642-566M | U4038 | SC10 47 |
| MP69 | CON-PART MIN HOUSING 1ROW 2P | 23435-167C | | |
| MP70 | CON-PART MIN HOUSING 1ROW 5P | 23435-168R | | |
| MP71 | CON-PART MIN HOUSING 1ROW 3P | 23435-171R | U2338 | MINI PV65039-034 |
| MP72 | CON-PART MIN SKT 22-26AWG REEL | 23435-178U | U2338 | MINI PV 47565 |
| MP73 | CON-PART MIN HOUSING 1ROW 7P | 23435-179Y | | |
| MP74 | CON-PART MIN POLARIZING KEY | 23435-190G | | |
| MP75 | CON-PART MIN HOUSING 1ROW 4P | 23435-198M | | |
| MP76 | CON-PART MIN HOUSING 1ROW 6P | 23435-992C | | |
| MP78 | CON-PART MIN HOUSING 1ROW 9P | 23435-998H | | |
| PLZ | CON-RF SMB-MALE 50RR BKHD ELB | 23444-351P | K1072 | GE65209MBN |
| R2 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R3 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R4 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R5 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R6 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R7 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R8 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R9 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R10 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R11 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R12 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R13 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R14 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R15 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R16 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R17 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AC0/AD0 - IF Box Assembly (AC/AD)** | | (Contd.) | | |
| UT5 | Cable Min Triaxial | 41700-086E | U2632 | 41700-086E |
| UT7 | Cable Assy | 43130-248K | U2632 | 43130-248K |
| UT8 | Cable Assy 16 Way Ribbon | 43129-952N | U2632 | 43129-952N |
| UT9 | Cable Assy 10 Way Ribbon | 43129-953L | U2632 | 43129-953L |
| UT10 | Cable Assy 14 Way Ribbon | 43129-954J | U2632 | 43129-954J |
| UT11 | Cable Assy Min Coax | 43129-972R | U2632 | 43129-972R |
| UT12 | Cable Assy Min Coax | 43129-975A | U2632 | 43129-975A |
| UT13 | Cable Assy Min Coax | 43129-976Z | U2632 | 43129-976Z |
| UT14 | Cable Assy | 43130-245C | U2632 | 43130-245C |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC1** | **- 50 MHz Crystal Oscillator** | | | |
| 35. When ordering, prefix circuit reference with AC1 | | | | |
| | Complete unit | 44828-540C | U2632 | 44828-540C |
| C1 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C2 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C10 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C11 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C12 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C13 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C14 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C15 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C16 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C17 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C18 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C20 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C21 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C22 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C23 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C25 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C26 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C30 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C31 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C32 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C33 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C34 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C35 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C36 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C37 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C40 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| D1 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D2 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D3 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D4 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D5 | DI RECT 1N4004 400V | 28357-028K | K8996 | 1N4004 |
| IC1 | ICA VREG+ LM317T ADJ 1.5A | 28461-726A | K5519 | LM317T |
| L2 | INDUCTOR (AC1) | 44290-873D | U2632 | 44290-873D |
| L3 | INDUCTOR (AC1) | 44290-872W | U2632 | 44290-872W |
| PLM | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC1** | **- 50 MHz Crystal Oscillator** (Contd.) | | | |
| PLN | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLP | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLS | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R2 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R3 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R4 | RES MF 39R .125W 2% 100PPM | 24772-039M | U0142 | CMF51 |
| R5 | RES MF 300R .125W 2% 100PPM | 24772-060L | U0142 | CMF51 |
| R6 | RES MF 1KO .125W 2% 100PPM | 24772-073X | U0142 | CMF51 |
| R7 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R8 | RES MF 20K .125W 2% 100PPM | 24772-104W | U0142 | CMF51 |
| R9 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R10 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R11 | RES MF 10K .125W 2% 100PPM | 24772-097S | U0142 | CMF51 |
| R12 | RES MF 150R .125W 2% 100PPM | 24772-053E | U0142 | CMF51 |
| R13 | RES MF 390R .125W 2% 100PPM | 24772-063G | U0142 | CMF51 |
| R14 | RES MF 2KO .125W 2% 100PPM | 24772-080B | U0142 | CMF51 |
| R15 | RES MF 2KO .125W 2% 100PPM | 24772-080B | U0142 | CMF51 |
| R16 | RES MF 820R .125W 2% 100PPM | 24772-071T | U0142 | CMF51 |
| R17 | RES MF 47R .125W 2% 100PPM | 24772-041X | U0142 | CMF51 |
| R20 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R21 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R22 | RES MF 39R .125W 2% 100PPM | 24772-039M | U0142 | CMF51 |
| R23 | RES MF 200R .125W 2% 100PPM | 24772-056N | U0142 | CMF51 |
| R24 | RES MF 200R .125W 2% 100PPM | 24772-056N | U0142 | CMF51 |
| R25 | RES MF 750R .125W 2% 100PPM | 24772-070D | U0142 | CMF51 |
| R26 | RES MF 47R .125W 2% 100PPM | 24772-041X | U0142 | CMF51 |
| R27 | RES MF 680R .25W 2% 100PPM | 24773-269K | K8996 | MR25 |
| R28 | RES MF 56R .125W 2% 100PPM | 24772-043C | U0142 | CMF51 |
| R32 | RES MF 10R .125W 2% 100PPM | 24772-025L | U0142 | CMF51 |
| R33 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R34 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R35 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R36 | RES MF 47R .125W 2% 100PPM | 24772-041X | U0142 | CMF51 |
| R37 | RES MF 47R .125W 2% 100PPM | 24772-041X | U0142 | CMF51 |
| R38 | RES MF 56R .125W 2% 100PPM | 24772-043C | U0142 | CMF51 |
| R40 | RES MF 360R .25W 2% 100PPM | 24773-262T | K8996 | MR25 |
| R41 | RES MF 2KO .125W 2% 100PPM | 24772-080B | U0142 | CMF51 |
| R42 | RES MF 2KO .125W 2% 100PPM | 24772-080B | U0142 | CMF51 |
| R43 | RES MF 24R .125W 2% 100PPM | 24772-034W | U0142 | CMF51 |
| R44 | RES MF 39R .125W 2% 100PPM | 24772-039M | U0142 | CMF51 |
| R45 | RES MF 330R .125W 2% 100PPM | 24772-061J | U0142 | CMF51 |
| R46 | RES MF 51R .125W 2% 100PPM | 24772-042M | U0142 | CMF51 |
| R47 | RES MF 430R .125W 2% 100PPM | 24772-064V | U0142 | CMF51 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC1** | **- 50 MHz Crystal Oscillator** | | (Contd.) | |
| R48 | RES MF 5K6 .125W 2% 100PPM | 24772-091N | U0142 | CMF51 |
| R49 | RES MF 47R .125W 2% 100PPM | 24772-041X | U0142 | CMF51 |
| R50 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R51 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R52 | RES MF 4K7 .125W 2% 100PPM | 24772-089L | U0142 | CMF51 |
| R53 | RES MF 24R .125W 2% 100PPM | 24772-034W | U0142 | CMF51 |
| R54 | RES MF 39R .125W 2% 100PPM | 24772-039M | U0142 | CMF51 |
| R55 | RES MF 820R .125W 2% 100PPM | 24772-071T | U0142 | CMF51 |
| R56 | RES MF 330R .125W 2% 100PPM | 24772-061J | U0142 | CMF51 |
| R58 | RES MF 220R .125W 2% 100PPM | 24772-057L | U0142 | CMF51 |
| R59 | RES MF 1K8 .125W 2% 100PPM | 24772-079A | U0142 | CMF51 |
| R60 | RES MF 100R .125W 2% 100PPM | 24772-049H | U0142 | CMF51 |
| R61 | RES MF 8R2 .125W 2% 100PPM | 24772-023Y | U0142 | CMF51 |
| TR1 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR2 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR3 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR4 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR5 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR7 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR8 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR9 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR10 | TR PSI 2N4959 30V 1G - LN AMP | 28433-836K | K5519 | 2N4959 |
| TR11 | TR PSI 2N4959 30V 1G - LN AMP | 28433-836K | K5519 | 2N4959 |
| TR13 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| XL1 | XTAL 50.0015M S 50R | 28312-086J | K8300 | HC 18/U |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC2** | **- 47.4 MHz IF amplifier** | | | |
| 36. When ordering, prefix circuit reference with AC2 | | | | |
| | Complete unit | 44828-473K | U2632 | 44828-473K |
| C1 | CAP CER 100N 30V 20% | 26383-031S | U4011 | ECK F1H104ZV |
| C2 | CAP CER 10P 63V 2% | 26343-465H | K8996 | 2222 682 |
| C3 | CAP CER 10P 63V 2% | 26343-465H | K8996 | 2222 682 |
| C4 | CAP-VAR PLAS 10P 2P TRIM | 26876-001F | K0099 | 5750 VPC |
| C5 | CAP CER 15P 63V 2% PLATE N470 | 26343-455M | K8996 | 2222 682 |
| C8 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C9 | CAP-VAR PLAS 10P 2P TRIM | 26876-001F | K0099 | 5750 VPC |
| C10 | CAP CER 8P2 63V .25P | 26343-464Z | K8996 | 2222 682 |
| C11 | CAP-VAR PLAS 10P 2P TRIM | 26876-001F | K0099 | 5750 VPC |
| C12 | CAP CER 8P2 63V .25P | 26343-464Z | K8996 | 2222 682 |
| C13 | CAP-VAR PLAS 10P 2P TRIM | 26876-001F | K0099 | 5750 VPC |
| C14 | CAP CER 8P2 63V .25P | 26343-464Z | K8996 | 2222 682 |
| C15 | CAP-VAR PLAS 10P 2P TRIM | 26876-001F | K0099 | 5750 VPC |
| C16 | CAP CER 8P2 63V .25P | 26343-464Z | K8996 | 2222 682 |
| C17 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C18 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C19 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C20 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C25 | CAP CER 100N 30V 20% | 26383-031S | U4011 | ECK F1H104ZV |
| C27 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C29 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C30 | CAP CER 82P 63V 2% | 26343-431A | K8996 | 2222 682 34829 |
| C31 | CAP CER 100N 30V 20% | 26383-031S | U4011 | ECK F1H104ZV |
| C32 | CAP CER 18P 63V 5% | 26343-468Y | K8996 | 2222 682 |
| C33 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C34 | CAP CER 47P 63V 5% | 26343-473L | K8996 | 2222 682 |
| C35 | CAP CER 100N 30V 20% | 26383-031S | U4011 | ECK F1H104ZV |
| C40 | CAP CER 100N 30V 20% | 26383-031S | U4011 | ECK F1H104ZV |
| C41 | CAP CER 100N 30V 20% | 26383-031S | U4011 | ECK F1H104ZV |
| C42 | CAP CER 100N 30V 20% | 26383-031S | U4011 | ECK F1H104ZV |
| C43 | CAP CER 68P 63V 2% | 26343-475F | K8996 | 2222 682 |
| C44 | CAP CER 68P 63V 2% | 26343-475F | K8996 | 2222 682 |
| C52 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C53 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C54 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C55 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C56 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C57 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C58 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C59 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC2** | **- 47.4 MHz IF amplifier** | | (Contd.) | |
| C60 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C61 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C62 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C63 | CAP CER 15P 63V 2% PLATE N470 | 26343-455M | K8996 | 2222 682 |
| C64 | CAP CER 100P 63V 2% PLATE N150 | 26343-437N | K8996 | 2222 682 34101 |
| D1 | DI ZEN BZX79C6V8 6.8V 5% | 28371-550W | K8996 | BZX79 C6V8 |
| IC1 | ICA SW SD5002 QUAD DMOS 7.5V ! | 28469-717Y | K7068 | SD5002N OR I |
| IC2 | ICA AMP TL072CP DUAL FET I/P | 28461-348Z | K5519 | TL072CP |
| IC3 | ICA SW SD5002 QUAD DMOS 7.5V ! | 28469-717Y | K7068 | SD5002N OR I |
| IC4 | ICA AMP TL074CN QUAD FET I/P | 28461-349H | K5519 | TL074CN |
| L1 | IND CHOKE .82UH 5% | 23642-454V | U4251 | 3640 19 |
| L2 | INDUCTOR | 34900-927V | U2632 | 34900-927V |
| L3 | INDUCTOR | 34900-927V | U2632 | 34900-927V |
| L4 | INDUCTOR | 34900-927V | U2632 | 34900-927V |
| L5 | INDUCTOR | 34900-927V | U2632 | 34900-927V |
| L6 | IND CHOKE .22UH 10% LAQ | 23642-545E | U4038 | SC10 05 |
| L7 | IND CHOKE 47UH 10% LAQ | 23642-559D | U4038 | SC10 33 |
| L8 | IND CHOKE 47UH 10% LAQ | 23642-559D | U4038 | SC10 33 |
| L9 | IND CHOKE .68UH 10% LAQ | 23642-548N | U4038 | SC10 33 |
| L10 | IND CHOKE .1UH 20% LAQ | 23642-543N | U4038 | SC10 33 |
| | INDUCTOR ASSY | 44190-048L | | |
| R1 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R2 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R3 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R4 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R5 | RES MF 36R .25W 2% 100PPM | 24773-238A | K8996 | MR25 |
| R6 | RES MF 680R .25W 2% 100PPM | 24773-269K | K8996 | MR25 |
| R7 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R8 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R9 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R10 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R11 | RES MF 22R .25W 2% 100PPM | 24773-233M | K8996 | MR25 |
| R12 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R13 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R14 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R15 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R16 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R17 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R18 | RES CC 51R .125W 5% | 24331-989P | U0914 | BB5105 |
| R19 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R20 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC2** | **- 47.4 MHz IF amplifier** | (Contd.) | | |
| R21 | RV CERM 50R LI .5W 10% | 25711-634N | U0914 | E2A |
| R22 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R23 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R24 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R25 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R26 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R27 | RES MF 75R .25W 2% 100PPM | 24773-246Y | K8996 | MR25 |
| R28 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R29 | RV CERM 500R LI .5W 10% | 25711-637F | U0914 | E2A |
| R30 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R31 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R32 | RES CC 51R .125W 5% | 24331-989P | U0914 | BB5105 |
| R33 | RES CC 51R .125W 5% | 24331-989P | U0914 | BB5105 |
| R34 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R35 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R36 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R37 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R39 | RES MF 360R .25W 2% 100PPM | 24773-262T | K8996 | MR25 |
| R40 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R41 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R46 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R47 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R48 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R49 | RES MF 180R .25W 2% 100PPM | 24773-255V | K8996 | MR25 |
| R50 | RES MF 1K8 .25W .1% 25PPM | 24723-395F | K8479 | H8 |
| R51 | RES MF 200R .25W .1% 25PPM | 24723-396G | K8479 | H8 |
| R52 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R53 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R54 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R55 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R56 | RES MF 649R .25W .1% 25PPM | 24723-398S | K8479 | H8 |
| R57 | RES MF 300R .25W .1% 25PPM | 24723-397V | K8479 | H8 |
| R58 | RES MF 3K9 .25W 2% 100PPM | 24773-287V | K8996 | MR25 |
| R59 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R60 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R61 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R62 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R63 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R64 | RES MF 120R .25W 2% 100PPM | 24773-251L | K8996 | MR25 |
| R65 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R66 | RES MF 180R .25W 2% 100PPM | 24773-255V | K8996 | MR25 |
| R67 | RES MF 1K8 .25W .1% 25PPM | 24723-395F | K8479 | H8 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC2** | **- 47.4 MHz IF amplifier** | (Contd.) | | |
| R68 | RES MF 200R .25W .1% 25PPM | 24723-396G | K8479 | H8 |
| R69 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R70 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R71 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| TR1 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR2 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR3 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR5 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR6 | TR NJF U431 25V - 24MA DUA | 28459-041G | K7068 | U431 |
| TR7 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR8 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR11 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR12 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR15 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR16 | TR NSI 2N3904 40V 250M - GEN | 28454-786H | K5519 | 2N3904 |
| TR17 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| T1 | TRANSFORMER ASSY. | 43590-117W | U2632 | 43590-117W |
| T2 | TRANSFORMER ASSY. | 43590-169E | | |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC3** | **- 2.6 MHz LC filter** | | | |
| 37. When ordering, prefix circuit reference with AC3 | | | | |
| | Complete unit | 44828-474A | U2632 | 44828-474A |
| C1 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C2 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C3 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C4 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C5 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C6 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C7 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C8 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C9 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C10 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C11 | CAP CER 3P9 63V OP5 | 26343-496Z | K8996 | 2222 678 09398 |
| C12 | CAP-VAR PLAS 200P 15P TRIM | 26878-401B | K8996 | 2222 808 44201 |
| C13 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C14 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C15 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C16 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C17 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C18 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C19 | CAP CER 4P7 63V OP5 | 26343-485P | K8996 | 2222 678 09478 |
| C20 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C21 | CAP CER 15P 63V 5% | 26343-493B | K8996 | 2222 678 10159 |
| C22 | CAP-VAR PLAS 200P 15P TRIM | 26878-401B | K8996 | 2222 808 44201 |
| C23 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C24 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C25 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C26 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C27 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C28 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C29 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C30 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C31 | CAP CER 3P9 63V OP5 | 26343-496Z | K8996 | 2222 678 09398 |
| C32 | CAP-VAR PLAS 200P 15P TRIM | 26878-401B | K8996 | 2222 808 44201 |
| C33 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C34 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C35 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C36 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C37 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C38 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C39 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C40 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC3** | **- 2.6 MHz LC filter** | | | (Contd.) |
| C41 | CAP CER 4P7 63V 0P5 | 26343-485P | K8996 | 2222 678 09478 |
| C42 | CAP-VAR PLAS 200P 15P TRIM | 26878-401B | K8996 | 2222 808 44201 |
| C43 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C44 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C45 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C46 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C47 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C48 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C49 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C50 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C51 | CAP CER 15P 63V 5% PLATE | 26343-493B | K8996 | 2222 678 10159 |
| C52 | CAP-VAR PLAS 200P 15P TRIM | 26878-401B | K8996 | 2222 808 44201 |
| C53 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C54 | CAP CER 2N2 100V 5% | 26343-557M | U2109 | SR211A222JAA |
| C55 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C56 | CAP CER 56P 63V 2% | 26343-474J | K8996 | 2222 682 |
| C57 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C58 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C59 | CAP CER 3P9 63V 0P5 | 26343-496Z | K8996 | 2222 678 09398 |
| C60 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C61 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C62 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C63 | CAP CER 4P7 63V 0P5 | 26343-485P | K8996 | 2222 678 09478 |
| C64 | CAP CER 15P 63V 2% | 26343-493B | K8996 | 2222 678 10159 |
| C65 | CAP CER 3P9 63V 0P5 | 26343-496Z | K8996 | 2222 678 09398 |
| C66 | CAP CER 4P7 63V 0P5 | 26343-485P | K8996 | 2222 678 09478 |
| C67 | CAP CER 15P 63V 2% | 26343-493B | K8996 | 2222 678 10159 |
| C68 | CAP CER 3P9 63V 0P5 | 26343-496Z | K8996 | 2222 678 09398 |
| C69 | CAP CER 4P7 63V 0P5 | 26343-485P | K8996 | 2222 678 09478 |
| C70 | CAP CER 15P 63V 5% | 26343-493B | K8996 | 2222 678 10159 |
| C71 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C73 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C74 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C75 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C76 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C77 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C78 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C79 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C80 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C81 | CAP CER 1N5 63V 10% | 26383-603U | U3967 | SEC 04-BX-1500PF |
| C82 | CAP CER 1N5 63V 10% | 26383-603U | U3967 | SEC 04-BX-1500PF |
| C83 | CAP PETP 47N 63V 10% | 26582-428J | K1945 | R68 D C 4702 AAK |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AC3** | **- 2.6 MHz LC filter** | | (Contd.) | | |
| D1 | DI PIN 5082-3379 50V | ! | 28383-997T | K3464 | HP5082 3379 |
| D2 | DI PIN 5082-3379 50V | ! | 28383-997T | K3464 | HP5082 3379 |
| D3 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D4 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D5 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D6 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D7 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D8 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D9 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D10 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D11 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D12 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D13 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| IC1 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC2 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC3 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC4 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC5 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC6 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC7 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC8 | ICA AMP TL074CN QUAD FET I/P | | 28461-349H | K5519 | TL074CN |
| IC9 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC10 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| L1 | IND CHOKE 680UH 10% LAQ | | 23642-566M | U4038 | SC10 47 |
| L2 | IND CHOKE 33UH 10% LAQ | | 23642-558W | U4038 | SC10 31 |
| L3 | IND CHOKE 33UH 10% LAQ | | 23642-558W | U4038 | SC10 31 |
| L11 | COIL ASSY. | | 44190-035R | U2632 | 44190-035R |
| L12 | COIL ASSY. | | 44190-035R | U2632 | 44190-035R |
| L13 | COIL ASSY. | | 44190-035R | U2632 | 44190-035R |
| L14 | COIL ASSY. | | 44190-035R | U2632 | 44190-035R |
| L15 | COIL ASSY. | | 44190-035R | U2632 | 44190-035R |
| R1 | RES MF 3K09 .25W .1% 25PPM | | 24723-399W | K8479 | H8 |
| R2 | RES MF 100R9 .25W .1% 25PPM | | 24723-400J | K8479 | H8 |
| R3 | RES MF 100R .25W 2% 100PPM | | 24773-249J | K8996 | MR25 |
| R4 | RES MF 1M0 .25W 2% 100PPM | | 24773-346E | U2453 | LR1 OR PR1 |
| R6 | RES MF 2K0 .25W 2% 100PPM | | 24773-280U | K8996 | MR25 |
| R7 | RES MF 1K0 .25W 2% 100PPM | | 24773-273A | K8996 | MR25 |
| R8 | RES MF 1K0 .25W 2% 100PPM | | 24773-273A | K8996 | MR25 |
| R9 | RES MF 1K0 .25W 2% 100PPM | | 24773-273A | K8996 | MR25 |
| R10 | RES MF 18R .25W 2% 100PPM | | 24773-231P | K8996 | MR25 |
| R11 | RES MF 2K0 .25W 2% 100PPM | | 24773-280U | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC3** | **- 2.6 MHz LC filter** | (Contd.) | | |
| R12 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R13 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R14 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R15 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R16 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R17 | RES MF 18R .25W 2% 100PPM | 24773-231P | K8996 | MR25 |
| R18 | RES MF 18R .25W 2% 100PPM | 24773-231P | K8996 | MR25 |
| R19 | RES MF 18R .25W 2% 100PPM | 24773-231P | K8996 | MR25 |
| R20 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R21 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R22 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R23 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R24 | RES MF 620R .25W 2% 100PPM | 24773-268B | K8996 | MR25 |
| R25 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R26 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R27 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R28 | RES MF 18R .25W 2% 100PPM | 24773-231P | K8996 | MR25 |
| R30 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R31 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R32 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R33 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R34 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R35 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R36 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R37 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R38 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R39 | RV CERM 2KO LI .5W 10% | 25711-639V | U0914 | E2A |
| R40 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R41 | RV THERM 470R 10% DISC | 25685-402U | K8996 | 2332-642-62471 |
| R42 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R43 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R44 | RES MF 620R .25W 2% 100PPM | 24773-268B | K8996 | MR25 |
| R45 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R46 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R47 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R48 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R49 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R50 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R51 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R52 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R53 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R54 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R55 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC3** | **- 2.6 MHZ LC FILTER** | (Contd.) | | |
| R56 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R57 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R58 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R59 | RV CERM 2K0 LI .5W 10% | 25711-639V | U0914 | E2A |
| R60 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R61 | RV THERM 470R NTC 0.5W 10% | 25685-402U | K8996 | 2332-642-62471 |
| R62 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R63 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R64 | RES MF 620R .25W 2% 100PPM | 24773-268B | K8996 | MR25 |
| R65 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R66 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R67 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R68 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R69 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R70 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R71 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R72 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R73 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R74 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R75 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R76 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R77 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R78 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R79 | RV CERM 2K0 LI .5W 10% | 25711-639V | U0914 | E2A |
| R80 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R81 | RV THERM 470R NTC 0.5W 10% | 25685-402U | K8996 | 2332-642-62471 |
| R82 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R83 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R84 | RES MF 620R .25W 2% 100PPM | 24773-268B | K8996 | MR25 |
| R85 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R86 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R87 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R88 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R89 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R90 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R91 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R92 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R93 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R94 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R95 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R96 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R97 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC3** | **- 2.6 MHz LC filter** | (Contd.) | | |
| R98 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R99 | RV CERM 2K0 LI .5W 10% HORZ | 25711-639V | U0914 | E2A |
| R100 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R101 | RV THERM 470R 10% DISC | 25685-402U | K8996 | 2332-642-62471 |
| R102 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R103 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R104 | RES MF 620R .25W 2% 100PPM | 24773-268B | K8996 | MR25 |
| R105 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R106 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R107 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R108 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R109 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R110 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R111 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R112 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R113 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R114 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R115 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R116 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R117 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R118 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R119 | RV CERM 2K0 LI .5W 10% | 25711-639V | U0914 | E2A |
| R120 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R121 | RV THERM 470R 10% DISC | 25685-402U | K8996 | 2332-642-62471 |
| R122 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R123 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R124 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R125 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R126 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R127 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R128 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R129 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R130 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R131 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R132 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R133 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R134 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R135 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R136 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R137 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R138 | RES MF 11K .25W 2% 100PPM | 24773-298C | K8996 | MR25 |
| R142 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC3** | **- 2.6 MHz LC filter** | (Contd.) | | |
| R144 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R145 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R146 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R147 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R148 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R149 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R150 | RES MF 300R .25W 2% 100PPM | 24773-260W | K8996 | MR25 |
| R151 | RV CERM 20K LI 10% | 25748-565V | K0718 | R20K |
| R152 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R153 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| TR1 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR2 | TR NSI 2N3904 40V 250M - GEN | 28454-786H | K5519 | 2N3904 |
| TR3 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR4 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR7 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR8 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR9 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR10 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR11 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR12 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR13 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR14 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR15 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR16 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR17 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR18 | TR NSI 2N3904 40V 250M - GEN | 28454-786H | K5519 | 2N3904 |
| T1 | TRANSFORMER | 43590-169U | U2632 | 43590-115V |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC4** | **- 100 kHz IF crystal filter** | | | |
| 38. When ordering, prefix circuit reference with AC4 | | | | |
| | Complete unit | 44828-475Z | U2632 | 44828-475Z |
| C1 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C2 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C3 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C4 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C5 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C6 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C7 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C9 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C10 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C11 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C12 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C13 | CAP CER 150P 63V 2% | 26343-479W | K8996 | 2222 682 |
| C14 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C20 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C21 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C22 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C23 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C24 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C25 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C26 | CAP CER 33P 63V 2% | 26343-471Y | K8996 | 2222 682 |
| C30 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C31 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C32 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C40 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C41 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C42 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C43 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C44 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C45 | CAP CER 33P 63V 2% | 26343-471Y | K8996 | 2222 682 |
| C50 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C51 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C52 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C60 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C61 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C62 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C63 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C64 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C65 | CAP CER 33P 63V 2% | 26343-471Y | K8996 | 2222 682 |
| C70 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C71 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC4** | **- 100 kHz IF crystal filter** | | (Contd.) | |
| C72 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C80 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C81 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C82 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C83 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C84 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C85 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C86 | CAP CER 33P 63V 2% | 26343-471Y | K8996 | 2222 682 |
| C87 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C88 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C90 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C91 | CAP CER 22P 63V 2% | 26343-469N | K8996 | 2222 682 |
| C92 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C100 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C101 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C102 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C103 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C104 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C106 | CAP CER 33P 63V 2% | 26343-471Y | K8996 | 2222 682 |
| C110 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C111 | CAP CER 47P 63V 2% | 26343-473L | K8996 | 2222 682 |
| C112 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C120 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C122 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C123 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C124 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C125 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C126 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C127 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C128 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C129 | CAP CER 4P7 63V 0.25P | 26343-485P | K8996 | 2222 682 09478 |
| C130 | CAP CER 4P7 63V 0.25P | 26343-485P | K8996 | 2222 682 09478 |
| C132 | CAP CER 4P7 63V 0.25P | 26343-485P | K8996 | 2222 682 09478 |
| C133 | CAP CER 4P7 63V 0.25P | 26343-485P | K8996 | 2222 682 09478 |
| C134 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C135 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C136 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C137 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| D1 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |
| D2 | DI V/CAP BB809 3V 29PF | 28381-132G | K8996 | BB809 |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AC4** | **- 100 kHZ IF crystal filter** | | | (Contd.) | |
| D3 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D4 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D5 | DI V/CAP BB809 3V 29PF | | 28381-132G | K8996 | BB809 |
| D6 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D7 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| IC1 | ICA SW SD5002 QUAD DMOS 7.5V | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC2 | ICD FF-D 74S74 DUAL +EDG TR | | 28462-607K | K0461 | SN74S74N |
| IC3 | ICD NAND 74LS03 QUAD 2INP O/C | | 28466-346E | K5519 | SN74LS03N |
| IC4 | ICD NAND 74LS03 QUAD 2INP O/C | | 28466-346E | K5519 | SN74LS03N |
| IC5 | ICD NAND 74LS03 QUAD 2INP O/C | | 28466-346E | K5519 | SN74LS03N |
| IC6 | ICD INV 74LS04 HEX | | 28469-144S | K8996 | PC74HCT04P |
| IC7 | ICA SW SD5002 QUAD DMOS | ! | 28469-717Y | K7068 | SD5002N OR I |
| IC11 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| L1 | IND CHOKE 150UH 10% LAQ | | 23642-562D | U4038 | SC10 39 |
| L2 | IND CHOKE 22MH 10% MOULDED AX | | 23642-401C | U4251 | 551 3201 65 0200 |
| L3 | IND CHOKE 22MH 10% MOULDED AX | | 23642-401C | U4251 | 551 3201 65 0200 |
| L4 | IND CHOKE 22MH 10% MOULDED AX | | 23642-401C | U4251 | 551 3201 65 0200 |
| L5 | IND CHOKE 22MH 10% MOULDED AX | | 23642-401C | U4251 | 551 3201 65 0200 |
| L6 | IND CHOKE 22MH 10% MOULDED AX | | 23642-401C | U4251 | 551 3201 65 0200 |
| L7 | IND CHOKE 470UH 10% LAQ | | 23642-565X | U4038 | SC10 45 |
| L8 | IND CHOKE 10% LAQ | | 23642-567C | U4038 | SC10 49 |
| R1 | RES MF 10K .25W 2% 100PPM | | 24773-297M | K8996 | MR25 |
| R2 | RES MF 10K .25W 2% 100PPM | | 24773-297M | K8996 | MR25 |
| R3 | RES MF 62R .25W 2% 100PPM | | 24773-244E | K8996 | MR25 |
| R4 | RES MF 1K2 .25W 2% 100PPM | | 24773-275H | K8996 | MR25 |
| R5 | RES MF 12K .25W 2% 100PPM | | 24773-299R | K8996 | MR25 |
| R7 | RES MF 2K0 .25W 2% 100PPM | | 24773-280U | K8996 | MR25 |
| R9 | RES MF 47K .25W 2% 100PPM | | 24773-313H | K8996 | MR25 |
| R10 | RES MF 2K0 .25W 2% 100PPM | | 24773-280U | K8996 | MR25 |
| R11 | RES MF 100R .25W 2% 100PPM | | 24773-249J | K8996 | MR25 |
| R12 | RES MF 330R .25W 2% 100PPM | | 24773-261D | K8996 | MR25 |
| R13 | RV CERM 5K0 LI .5W 10% | | 25711-640F | U0914 | E2A |
| R14 | RES MF 22K .25W 2% 100PPM | | 24773-305R | K8996 | MR25 |
| R15 | RV CERM 50K LI .5W 10% | | 25711-643S | U0914 | E2A |
| R16 | RES MF 1K0 .25W 2% 100PPM | | 24773-273A | K8996 | MR25 |
| R17 | RV CERM 50K LI .5W 10% | | 25711-643S | U0914 | E2A |
| R18 | RES MF 1K5 .25W 2% 100PPM | | 24773-275H | K8996 | MR25 |
| R19 | RES MF 1K0 .25W 2% 100PPM | | 24773-273A | K8996 | MR25 |
| R20 | RES MF 100R .25W 2% 100PPM | | 24773-249J | K8996 | MR25 |
| R21 | RES MF 3K3 .25W 2% 100PPM | | 24773-285F | K8996 | MR25 |
| R22 | RES MF 510R .25W 2% 100PPM | | 24773-266C | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC4** | **- 100 kHz IF crystal filter** | (Contd.) | | |
| R23 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R24 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R25 | RV CERM 1K0 LI .5W 10% | 25711-638G | U0914 | E2A |
| R26 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R27 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R28 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R29 | RES MG 10M .25W 5% | 24321-885W | K8996 | MR25 |
| R30 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R32 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R33 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R34 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R35 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R36 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R37 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R38 | RES MG 10M .25W 5% | 24321-885W | K8996 | MR25 |
| R39 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R40 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R41 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R42 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R43 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R44 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R45 | RV CERM 1K0 LI .5W 10% | 25711-638G | U0914 | E2A |
| R46 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R47 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R48 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R52 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R58 | RES MG 10M .25W 5% | 24321-885W | K8996 | MR25 |
| R59 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R60 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R61 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R62 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R63 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R64 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R65 | RV CERM 1K0 LI .5W 10% | 25711-638G | U0914 | E2A |
| R66 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R67 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R68 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R72 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R78 | RES MG 10M .25W 5% | 24321-885W | K8996 | MR25 |
| R79 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2AR80 |
| R80 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R81 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R82 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC4** | **- 100 kHz IF crystal filter** | (Contd.) | | |
| R83 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R84 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R85 | RV CERM 1K0 LI .5W 10% | 25711-638G | U0914 | E2A |
| *R86 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R87 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R88 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R89 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R92 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R93 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R94 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R95 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R96 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R98 | RES MG 10M .25W 5% | 24321-885W | K8996 | MR25 |
| R99 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R100 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R101 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R102 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R103 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R104 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R105 | RV CERM 1K0 LI .5W 10% | 25711-638G | U0914 | E2A |
| R106 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R107 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| R108 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R109 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R110 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R112 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R119 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R120 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R121 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R122 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R123 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R124 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R125 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R126 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R127 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R128 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R129 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R130 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R131 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R132 | RES MF 43K .25W 2% 100PPM | 24773-312Z | K8996 | MR25 |
| R133 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R134 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC4** | **- 100 kHz IF crystal filter** (Contd.) | | | |
| TR1 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR2 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR6 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR7 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR8 | TR NSI BC208B 20V 150M - GEN | 28452-781A | K1196 | ZTX108BL |
| TR9 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR10 | TR NSI BC208B 20V 150M - GEN | 28452-781A | K1196 | ZTX108BL |
| TR13 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR14 | TR NSI BC208B 20V 150M - GEN | 28452-781A | K1196 | ZTX108BL |
| TR15 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR16 | TR NSI BC208B 20V 150M - GEN | 28452-781A | K1196 | ZTX108BL |
| TR18 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR19 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR20 | TR NSI BC208B 20V 150M - GEN | 28452-781A | K1196 | ZTX108BL |
| TR21 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR22 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| T1 | TRANSFORMER ASSY | 43590-170H | | |
| T2 | TRANSFORMER ASSY | 43590-167H | | |
| T3 | BALUN TRANS | 43590-114G | U2632 | 43590-114G |
| T4 | TRANSFORMER ASSY | 43590-158C | U2632 | 43590-158C |
| T5 | TRANSFORMER ASSY | 43590-158C | U2632 | 43590-158C |
| T6 | TRANSFORMER ASSY | 43590-158C | U2632 | 43590-158C |
| T7 | TRANSFORMER ASSY | 43590-158C | U2632 | 43590-158C |
| XL1 | XTAL 0.1M S50P 750R 60H SET 5 | 28311-372U | K0142 | QC1087 |
| XL2 | XTAL 0.1M S50P 750R 60H SET 5 | 28311-372U | K0142 | QC1087 |
| XL3 | XTAL 0.1M S50P 750R 60H SET 5 | 28311-372U | K0142 | QC1087 |
| XL4 | XTAL 0.1M S50P 750R 60H SET 5 | 28311-372U | K0142 | QC1087 |
| XL5 | XTAL 0.1M S50P 750R 60H SET 5 | 28311-372U | K0142 | QC1087 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| Board AC5 | **- 2.6 MHz crystal filter** | | | |
| 39. When ordering, prefix circuit reference with AC5 | | | | |
| | Complete unit | 44828-476H | U2632 | 44828-476H |
| C1 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C2 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C3 | CAP CER 27P 63V 2% | 26343-470U | K8996 | 2222 682 |
| C4 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C5 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C6 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C7 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C8 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C9 | CAP-VAR PLAS 5P5 1P4 TRIM | 26878-409N | K8996 | 222-809-09001 |
| C10 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C11 | CAP CER 10P 63V 2% | 26343-465H | K8996 | 2222 682 |
| C12 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C13 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C14 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C15 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C16 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C17 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C18 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C19 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C20 | CAP-VAR PLAS 5P5 1P4 TRIM | 26878-409N | K8996 | 222-809-09001 |
| C21 | CAP CER 10P 63V 0P5 PLATE | 26343-465H | K8996 | 2222 682 |
| C22 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C23 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C24 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C25 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C27 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C28 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C29 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C30 | CAP CER 10P 63V 0P5 | 26343-465H | K8996 | 2222 682 |
| C31 | CAP-VAR PLAS 5P5 1P4 TRIM | 26878-409N | K8996 | 222-809-09001 |
| C32 | CAP CER 10P 63V 0P5 PLATE | 26343-465H | K8996 | 2222 682 |
| C33 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C34 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C35 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C36 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C37 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C38 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C39 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C40 | CAP-VAR PLAS 5P5 1P4 TRIM | 26878-409N | K8996 | 222-809-09001 |
| C41 | CAP CER 10P 63V 0P5 PLATE | 26343-465H | K8996 | 2222 682 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC5** | **- 2.6 MHz crystal filter** | | (Contd.) | |
| C42 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C43 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C44 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C45 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C46 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C47 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C49 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C51 | CAP-VAR PLAS 5P5 1P4 TRIM | 26878-409N | K8996 | 222-809-09001 |
| C52 | CAP CER 10P 63V 2% | 26343-465H | K8996 | 2222 682 |
| C53 | CAP-VAR PLAS 22P 2P TRIM | 26878-407U | K8996 | 2222 808 11229 |
| C54 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C55 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C56 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C57 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C58 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C59 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C60 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C61 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C62 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C64 | CAP CER 10P 63V 2% | 26343-465H | K8996 | 2222 682 |
| C65 | CAP CER 10P 63V OP5 | 26343-465H | K8996 | 2222 682 |
| C66 | CAP CER 10P 63V OP5 | 26343-465H | K8996 | 2222 682 |
| C67 | CAP CER 10P 63V OP5 | 26343-465H | K8996 | 2222 682 |
| C68 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| D1 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D2 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D3 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D4 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D6 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D7 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D8 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D9 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D10 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D11 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D12 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D13 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D14 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D15 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D16 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D17 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC5** | **- 2.6 MHz crystal filter** | | (Contd.) | |
| D18 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D19 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D20 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D21 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D22 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D23 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D24 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D25 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D26 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D27 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D28 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D29 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D30 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D31 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| IC1 | ICA AMP TL074CN QUAD FET I/P | 28461-349H | K5519 | TL074CN |
| L1 | IND CHOKE 100UH 10% LAQ | 23642-561W | U4038 | SC10 37 |
| L2 | INDUCTOR | 44290-869W | U2632 | 44290-869W |
| L3 | INDUCTOR | 44290-869W | U2632 | 44290-869W |
| L4 | INDUCTOR | 44290-869W | U2632 | 44290-869W |
| L5 | INDUCTOR | 44290-869W | U2632 | 44290-869W |
| L6 | INDUCTOR | 44290-869W | U2632 | 44290-869W |
| R1 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R2 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R3 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R4 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R5 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R6 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R7 | RV CERM 2K0 LI .5W 10% | 25711-639V | U0914 | E2A |
| R8 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R9 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R10 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R11 | RV CERM 5K0 LI .5W 10% | 25711-640F | U0914 | E2A |
| R12 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R13 | RES MF 2K2 .25W 2% 100PPM | 24773-281Y | K8996 | MR25 |
| R14 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R15 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R16 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R17 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC5** | **- 2.6 MHz crystal filter** | | (Contd.) | |
| R18 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R19 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R20 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R21 | RES MF 2K2 .25W 2% 100PPM | 24773-281Y | K8996 | MR25 |
| R22 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R23 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R24 | RES MF 12K .25W 2% 100PPM | 24773-299R | K8996 | MR25 |
| R25 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R26 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R27 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R28 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R29 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R30 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R31 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R32 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R33 | RES MF 51K .25W 2% 100PPM | 24773-314E | K8996 | MR25 |
| R34 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R35 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R36 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R37 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R38 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R39 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R40 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R41 | RES MF 1K3 .25W 2% 100PPM | 24773-276E | K8996 | MR25 |
| R42 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R43 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R44 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R45 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R46 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R47 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R48 | RES MF 51K .25W 2% 100PPM | 24773-314E | K8996 | MR25 |
| R49 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R50 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R51 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R52 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R53 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R54 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R55 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R56 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R57 | RES MO 470R .5W 2% 250PPM | 24573-065J | K4184 | TR5 OR TRM5ORNK5 |
| R58 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R59 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R60 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC5** | **- 2.6 MHz crystal filter** | | (Contd.) | |
| R61 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R62 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R63 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R64 | RES MF 51R .25W 2% 100PPM | 24773-314E | K8996 | MR25 |
| R65 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R66 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R67 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R68 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R69 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R70 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R71 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R72 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R73 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R74 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R75 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R76 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R77 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R78 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R79 | RES MF 51K .25W 2% 100PPM | 24773-314E | K8996 | MR25 |
| R80 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R81 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R82 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R83 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R84 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R85 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R86 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R87 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R88 | RES MO 470R .5W 2% 250PPM | 24573-065J | K4184 | TR5 OR TRM5ORNK5 |
| R89 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R90 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R91 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R92 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R93 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R94 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R95 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R96 | RES MF 51K .25W 2% 100PPM | 24773-314E | K8996 | MR25 |
| R97 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R98 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R99 | RES MF 8K2 .25W 2% 100PPM | 24773-295P | K8996 | MR25 |
| R100 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R101 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R102 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC5** | **- 2.6 MHz crystal filter** | | (Contd.) | |
| R103 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R104 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R105 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R106 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R107 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R108 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R109 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R110 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R111 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R112 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R113 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R114 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R115 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R116 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R117 | RES MF 1MO .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R118 | RES MF 1KO .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R119 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R120 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R121 | RES MF 1/4W 2% 100PPM | 24773-302X | K8996 | MR25 |
| TR1 | TR PSI 2N4959 30V 1G - LN AMP | 28433-836K | K5519 | 2N4959 |
| TR2 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR3 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR4 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR5 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR6 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR7 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR8 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR9 | TR NSI 2N2219A 40V 300M - GEN | 28454-804V | K5519 | 2N2219A |
| TR10 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR11 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR12 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR13 | TR NSI 2N2219A 40V 300M - GEN | 28454-804V | K5519 | 2N2219A |
| TR14 | TR PSI BCY71 45V 200M - GEN | 28435-235L | K8996 | BCY71 |
| TR15 | TR NSI 2N2219A 40V 300M - GEN | 28454-804V | K5519 | 2N2219A |
| TR16 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR17 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| T1 | TRANSFORMER | 43590-148S | U2632 | 43590-148S |
| T2 | TRANSFORMER | 43590-148S | U2632 | 43590-148S |
| T3 | TRANSFORMER | 43590-148S | U2632 | 43590-148S |
| T4 | TRANSFORMER | 43590-148S | U2632 | 43590-148S |
| T5 | TRANSFORMER | 43590-148S | U2632 | 43590-148S |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC5** | **- 2.6 MHz crystal filter** | | (Contd.) | |
| XL1 | XTAL 2.6M S30P 100R 0.44H B | 28312-089V | K0142 | QC1107 |
| XL2 | XTAL 2.6M S30P 100R 0.47H A | 28312-090F | K0142 | QC1107 |
| XL3 | XTAL 2.6M S30P 100R 0.44H B | 28312-089V | K0142 | QC1107 |
| XL4 | XTAL 2.6M S30P 100R 0.47H A | 28312-090F | K0142 | QC1107 |
| XL5 | XTAL 2.6M S30P 100R 0.44H B | 28312-089V | K0142 | QC1107 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC6** | **- Phase detector** | | | |
| 40. When ordering, prefix circuit reference with AC6 | | | | |
| | Complete unit | 44828-477E | U2632 | 44828-477E |
| C1 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C2 | CAP CER 330P 63V 2% | 26343-483D | K6617 | EDPU |
| C3 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C4 | CAP CER 470P 400V 20% | 26383-139M | K1439 | SDPT4 D4000 |
| C5 | CAP PETP 68N 100V 10% | 26582-224J | K8300 | PMT2R OR PMC2R |
| C6 | CAP PETP 220N 63V 10% | 26582-406T | K8283 | M2B22101B |
| C7 | CAP PETP 220N 63V 10% | 26582-406T | K8283 | M2B22101B |
| C8 | CAP ELEC 4U7 50V 20% | 26421-011H | U2475 | LRVB 4.7/50M |
| C9 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C10 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C11 | CAP CER 22N 18V 20% | 26383-007R | U4011 | ECK F1H223ZV |
| C12 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C13 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C14 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C15 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C16 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C17 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C18 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C19 | CAP CER 15P 63V 5% | 26343-467U | K8996 | 2222 682 |
| C20 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C21 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| D1 | DI SIL 1N3062 75V JUNC | 28336-248R | K0461 | 1N3062 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| IC1 | ICA AMP TL071CP FET I/P DIL8 | 28461-347A | K5519 | TL071CP |
| IC2 | ICA AMP TL072CP DUAL FET I/P | 28461-348Z | K5519 | TL072CP |
| IC3 | ICA AMP TL072CP DUAL FET I/P | 28461-348Z | K5519 | TL072CP |
| IC4 | ICD MONO 74LS122 RETR | 28468-310C | K5519 | SN74LS122N |
| IC5 | ICD CTR 74LS92 4BIT 2,6,12 | 28464-125M | K5519 | SN74LS92N |
| IC6 | ICD CTR 74LS90 4BIT DEC 2,5,10 | 28464-014S | K5519 | SN74LS90N |
| IC7 | ICD CTR 74LS92 4BIT 2,6,12 | 28464-125M | K5519 | SN74LS92N |
| IC8 | ICD CTR 74LS90 4BIT DEC 2,5,10 | 28464-014S | K5519 | SN74LS90N |
| IC9 | ICD CTR 74S196 4BIT DEC | 28464-010J | K0461 | SN74S196(N/J) |
| IC10 | ICD INV 74LS04 HEX | 28469-171L | K5519 | SN74LS04N |
| L1 | CHOKE | 44290-951C | | |
| L2 | IND CHOKE 15UH 10% LAQ | 23642-556V | U4038 | SC10 27 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AC6** | **- Phase detector** | (Contd.) | | |
| R1 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R2 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R3 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R4 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R5 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R6 | RES MF 56K .25W 2% 100PPM | 24773-315U | K8996 | MR25 |
| R7 | RES MF 360K .25W 2% 100PPM | 24773-334X | U2453 | LR1 OR PR1 |
| R8 | RES MF 680K .25W 2% 100PPM | 24773-342K | U2453 | LR1 OR PR1 |
| R9 | RES MF 20K .25W 2% 100PPM | 24773-304C | K8996 | MR25 |
| R10 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R11 | RES MF 240K .25W 2% 100PPM | 24773-330W | K8996 | MR25 |
| R12 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R13 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R14 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R15 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R16 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R17 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R18 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R19 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R20 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R21 | RES MF 75K .25W 2% 100PPM | 24773-318L | K8996 | MR25 |
| R22 | RES MF 160R .25W 2% 100PPM | 24773-254G | K8996 | MR25 |
| R23 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R24 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| TR1 | TR PSI 2N4959 30V 1G - LN AMP | 28433-836K | K5519 | 2N4959 |
| TR2 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR3 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR4 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR5 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit ADO** | **- AD Tray** | | | |
| 41. When ordering, prefix circuit reference with ADO | | | | |
| | Complete unit | 44990-664T | U2632 | 44990-664T |
| C2 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C3 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C4 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C5 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C6 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C8 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C9 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C10 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C11 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C12 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C13 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C14 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C15 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C17 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C18 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C19 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C20 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C21 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C22 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C23 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C24 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C25 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C26 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C27 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C28 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C29 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C30 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C31 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C32 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C33 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C34 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C35 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C36 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C37 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C38 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C39 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C40 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AD0** | **- AD Tray** | (Contd.) | | |
| C41 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C42 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C43 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C44 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C45 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C46 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C47 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C49 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C50 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C52 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C53 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C54 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C55 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C56 | CAP CER 1NO 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C59 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C60 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| L2 | IND | 34900-918Y | U2632 | 34900-918Y |
| L3 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L4 | IND | 34900-918Y | U2632 | 34900-918Y |
| L5 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L6 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L8 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L9 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L10 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L11 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L14 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L15 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L16 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L17 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L18 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L19 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L20 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L22 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L24 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L26 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L27 | IND CHOKE 470UH 10% SCREENED | 23642-333B | U4251 | 553 3635 33 |
| L28 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L30 | INDUCTOR ASSY | 44190-052J | U2632 | 44190-052J |
| MP33 | CON-PART MIN HOUSING 1ROW 3P | 23435-171R | U2338 | MINI PV65039-034 |
| MP34 | CON-PART MIN HOUSING 1ROW 2P | 23435-167C | | |
| MP35 | CON-PART MIN HOUSING 1ROW 5P | 23435-168R | | |
| MP36 | CON-PART MIN HOUSING 1ROW 6P | 23435-992C | | |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AD0** | **- AD Tray** | (Contd.) | | |
| MP37 | CON-PART MIN HOUSING 1ROW 7P | 23435-179Y | | |
| MP38 | CON-PART MIN SKT 22-26AWG REEL | 23435-178U | U2338 | MINI PV 47565 |
| MP39 | CON-PART MIN POLARIZING KEY | 23435-190G | | |
| MP42 | CON-PART MIN PIN 22-26AWG BOXD | 23435-968U | | |
| R1 | RES MF 270R .25W 2% 100PPM | 24773-259T | K8996 | MR25 |
| R2 | RES MF 270R .25W 2% 100PPM | 24773-259T | K8996 | MR25 |
| UT8 | Cable Assy | 43129-951Y | U2632 | 43129-951Y |
| UT9 | Cable Assy | 43129-955F | U2632 | 43129-955F |
| UT10 | Cable Assy | 43129-956G | U2632 | 43129-956G |
| UT11 | Cable Assy | 43130-246R | U2632 | 43130-246R |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | | | |
| 42. When ordering, prefix circuit reference with AD1 | | | | |
| | Complete unit | 44828-479Y | U2632 | 44828-479Y |
| C1 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C2 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C3 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C4 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C5 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C6 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C7 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C8 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C9 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C10 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C11 | CAP CER 12P 63V 5% | 26343-466E | K8996 | 2222 682 |
| C12 | CAP ELEC 100U 6.3V 20% | 26421-118L | U4011 | K100/6.3 |
| C13 | CAP CER 4P7 63V 0P5 | 26343-461B | K8996 | 2222 682 |
| C14 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C15 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C16 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C17 | CAP CER 1N0 63V 10% | 26383-602E | | |
| C18 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C19 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C20 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C21 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C22 | CAP CER 12P 63V 2% | 26343-466E | K8996 | 2222 682 |
| C23 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C24 | CAP ELEC 100U 6.3V 20% | 26421-118L | U4011 | K100/6.3 |
| C25 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C26 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C27 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C28 | CAP CER 1N0 63V 10% | 26383-602E | | |
| C29 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C30 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C31 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C32 | CAP CER 12P 63V 2% | 26343-466E | K8996 | 2222 682 |
| C33 | CAP ELEC 100U 6.3V 20% | 26421-118L | U4011 | K100/6.3 |
| C34 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C35 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C36 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C37 | CAP CER 1N0 63V 10% | 26383-602E | | |
| C38 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C39 | CAP PETP 10N 63V 10% | 26582-426N | K1945 | R68 D C 1002 AAK |
| C40 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | | (Contd.) | |
| C41 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C42 | CAP CER 12P 63V 5% | 26343-466E | K8996 | 2222 682 |
| C43 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C44 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C45 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C46 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C47 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C48 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C49 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C50 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C51 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C52 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C53 | CAP CER 100P 63V 2% | 26343-477V | K8996 | 2222 682 |
| C54 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C55 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C56 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C57 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C58 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C59 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C60 | CAP CER 680P 63V 10% | 26383-583P | K8996 | 630-18-681 |
| C61 | CAP CER 680P 63V 10% | 26383-583P | K8996 | 630-18-681 |
| C62 | CAP CER 27P 63V 2% | 26343-470U | K8996 | 2222 682 |
| C63 | CAP CER 27P 63V 2% | 26343-470U | K8996 | 2222 682 |
| C64 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C65 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C66 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C67 | CAP PS 2N2 63V 1% | 26538-910T | K4642 | EXFS/HR 2200/1% |
| C68 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C69 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C70 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C71 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C72 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C73 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C74 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C75 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C76 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C77 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C78 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C79 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| D1 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | | (Contd.) | | |
| D3 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D4 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D5 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D6 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D7 | DI ZEN BZX79C5V2 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D8 | DI ZEN BZX79C5V2 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D9 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D10 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D11 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D12 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D13 | DI ZEN BZX79C5V1 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D14 | DI ZEN BZX79C5V1 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D15 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D16 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D17 | DI ZEN BZX79C5V1 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D18 | DI ZEN BZX79C5V1 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D19 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D20 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D21 | DI ZEN BZX79C5V1 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D22 | DI ZEN BZX79C5V1 6.2V 5% | | 28371-481D | K8996 | BZX79 C6V2 |
| D23 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D24 | DI H/CARR HP5082-2811 | ! | 28349-008U | K3464 | HP5082 2811 |
| D25 | DI H/CARR HP5082-2811 | ! | 28349-008U | K3464 | HP5082 2811 |
| D26 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D27 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D28 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D29 | DI SIL 1N4148 75V JUNC | | 28336-676J | K8996 | 1N4148 |
| D30 | DI H/CARR BAT42 30V FAST | ! | 28349-013N | K6791 | BAT 42 |
| D31 | DI H/CARR BAT42 30V FAST | ! | 28349-013N | K6791 | BAT 42 |
| D32 | DI H/CARR BAT42 30V FAST | ! | 28349-013N | K6791 | BAT 42 |
| D33 | DI H/CARR BAT42 30V FAST | ! | 28349-013N | K6791 | BAT 42 |
| D34 | DI ZEN BZX79C3V9 3.9V 5% | | 28371-242D | K8996 | BZX79 C3V9 |
| IC1 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC2 | ICA SW SD500N QUAD DMOS | ! | 28469-735X | | |
| IC3 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC4 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-630W | K7093 | MM74HCT74N |
| IC5 | ICD NOR 74LS02 QUAD 2INP | | 28466-214Y | K5519 | SN74LS02N |
| IC6 | ICA SW SD500N QUAD DMOS | ! | 28469-735X | | |
| IC7 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC8 | ICA SW SD500N QUAD DMOS | ! | 28469-735X | | |
| IC9 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC10 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-630W | K7093 | MM74HCT74N |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | | (Contd.) | | |
| IC11 | ICA SW SD500N QUAD DMOS | ! | 28469-735X | | |
| IC12 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC13 | ICA COMP LM311N DIL8 | | 28461-695U | K5519 | LM311N |
| IC14 | ICA AMP TL072CP DUAL FET I/P | | 28461-348Z | K5519 | TL072CP |
| IC15 | ICA AMP TL071CP FET I/P DIL8 | | 28461-347A | K5519 | TL071CP |
| IC16 | ICA MISC SMP11GY S/H AMP H PRF | | 28461-929K | 06665 | SMP11(GYORFYOREY |
| L1 | IND CHOKE 150UH 10% LAQ | | 23642-562D | U4038 | SC10 39 |
| L2 | IND CHOKE 150UH 10% LAQ | | 23642-562D | U4038 | SC10 39 |
| L3 | IND CHOKE 150UH 10% LAQ | | 23642-562D | U4038 | SC10 39 |
| L4 | IND CHOKE 150UH 10% LAQ | | 23642-562D | U4038 | SC10 39 |
| R1 | RES MF 3K9 .25W 2% 100PPM | | 24773-287V | K8996 | MR25 |
| R2 | RES MF 100R .25W 2% 100PPM | | 24773-249J | K8996 | MR25 |
| R3 | RES MF 10R .25W 2% 100PPM | | 24773-225W | K8996 | MR25 |
| R4 | RES MF 10R .25W 2% 100PPM | | 24773-225W | K8996 | MR25 |
| R5 | RES MF 820R .25W 2% 100PPM | | 24773-271B | K8996 | MR25 |
| R7 | RES MF 470K .25W 2% 100PPM | | 24773-337R | U2453 | LR1 OR PR1 |
| R8 | RES MF 470K .25W 2% 100PPM | | 24773-337R | U2453 | LR1 OR PR1 |
| R10 | RES MF 4K7 .25W 2% 100PPM | | 24773-289W | K8996 | MR25 |
| R11 | RES MF 27K .25W 2% 100PPM | | 24773-307K | K8996 | MR25 |
| R12 | RES MF 12K .25W 2% 100PPM | | 24773-299R | K8996 | MR25 |
| R13 | RES MF 100R .25W 2% 100PPM | | 24773-249J | K8996 | MR25 |
| R14 | RES MF 2K7 .25W 2% 100PPM | | 24773-283L | K8996 | MR25 |
| R15 | RES MF 27K .25W 2% 100PPM | | 24773-307K | K8996 | MR25 |
| R16 | RES MF 1K0 .25W 2% 100PPM | | 24773-273A | K8996 | MR25 |
| R17 | RES MF 5K6 .25W 2% 100PPM | | 24773-291S | K8996 | MR25 |
| R18 | RES MF 180R .25W 2% 100PPM | | 24773-255V | K8996 | MR25 |
| R20 | RES MF 62K .25W 2% 100PPM | | 24773-316Y | K8996 | MR25 |
| R21 | RES MF 100R .25W 2% 100PPM | | 24773-249J | K8996 | MR25 |
| R22 | RES MF 6K2 .25W 2% 100PPM | | 24773-292W | K8996 | MR25 |
| R23 | RES MF 10R .25W 2% 100PPM | | 24773-225W | K8996 | MR25 |
| R24 | RES MF 560K .25W 2% 100PPM | | 24773-340R | U2453 | LR1 OR PR1 |
| R25 | RES MF 4K7 .25W 2% 100PPM | | 24773-289W | K8996 | MR25 |
| R26 | RES MF 10K .25W 2% 100PPM | | 24773-297M | K8996 | MR25 |
| R27 | RES MF 1K0 .25W 2% 100PPM | | 24773-273A | K8996 | MR25 |
| R28 | RES MF 2K7 .25W 2% 100PPM | | 24773-283L | K8996 | MR25 |
| R29 | RES MF 1K5 .25W 2% 100PPM | | 24773-277U | K8996 | MR25 |
| R30 | RES MF 4K7 .25W 2% 100PPM | | 24773-289W | K8996 | MR25 |
| R33 | RES MF 470R .25W 2% 100PPM | | 24773-265M | K8996 | MR25 |
| R34 | RES MF 22K .25W 2% 100PPM | | 24773-305R | K8996 | MR25 |
| R35 | RES MF 1K6 .25W 2% 100PPM | | 24773-278Y | K8996 | MR25 |
| R37 | RES MF 1K0 .25W 0.1% 15PPM | | 24723-306P | K8479 | H8 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | (Contd.) | | |
| R38 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R39 | RV CERM 10R LI .5W 10% | 25711-632U | U0914 | E2A |
| R40 | RES MF 54R2 .25W .1% 25PPM | 24723-411P | K8479 | H8 |
| R41 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R42 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R43 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R44 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R48 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R49 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R50 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R51 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R52 | RES MF 4K3 .25W 2% 100PPM | 24773-288S | K8996 | MR25 |
| R53 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R54 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R55 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R56 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R57 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R58 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R59 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R61 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R62 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R63 | RES MF 180R .25W 2% 100PPM | 24773-255V | K8996 | MR25 |
| R65 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R66 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R67 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R68 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R69 | RES MF 560K .25W 2% 100PPM | 24773-340R | U2453 | LR1 OR PR1 |
| R71 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R72 | RES MF 22K .25W 2% 100PPM | 24773-305R | K8996 | MR25 |
| R73 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R74 | RES MF 62K .25W 2% 100PPM | 24773-316Y | K8996 | MR25 |
| R75 | RES MF 1K0 .25W 0.1% 15PPM | 24723-306P | K8479 | H8 |
| R76 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R77 | RV CERM 10R LI .5W 10% | 25711-632U | U0914 | E2A |
| R78 | RES MF 54R2 .25W .1% 25PPM | 24723-411P | K8479 | H8 |
| R79 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R80 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R81 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R82 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R83 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R85 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R86 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R87 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | (Contd.) | | |
| R88 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R89 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R90 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R91 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R92 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R94 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R95 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R96 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R97 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R98 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R99 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R100 | RES MF 180R .25W 2% 100PPM | 24773-255V | K8996 | MR25 |
| R102 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R103 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R104 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R105 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R106 | RES MF 560K .25W 2% 100PPM | 24773-340R | U2453 | LR1 OR PR1 |
| R108 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R109 | RES MF 22K .25W 2% 100PPM | 24773-305R | K8996 | MR25 |
| R110 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R111 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R112 | RES MF 62K .25W 2% 100PPM | 24773-316Y | K8996 | MR25 |
| R113 | RES MF 1K0 .25W 0.1% 15PPM | 24723-306P | K8479 | H8 |
| R114 | RES MF 4R7 .25W 2% 100PPM | 24773-217J | U1395 | RC55 |
| R115 | RV CERM 10R LI .5W 10% | 25711-632U | U0914 | E2A |
| R116 | RES MF 54R2 .25W .1% 25PPM | 24723-411P | K8479 | H8 |
| R117 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R118 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R119 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R120 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R122 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R123 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R124 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R125 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R126 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R127 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |
| R128 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R129 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R130 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R131 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R132 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R133 | RES MF 11K .25W 2% 100PPM | 24773-298C | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | | (Contd.) | |
| R134 | RES MF 4K3 .25W 2% 100PPM | 24773-288S | K8996 | MR25 |
| R135 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R136 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R137 | RES MF 750R .25W 2% 100PPM | 24773-270R | K8996 | MR25 |
| R139 | RES MF 62K .25W 2% 100PPM | 24773-316Y | K8996 | MR25 |
| R140 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R141 | RES MF 6K2 .25W 2% 100PPM | 24773-292W | K8996 | MR25 |
| R142 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R143 | RES MF 560K .25W 2% 100PPM | 24773-340R | U2453 | LR1 OR PR1 |
| R144 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R145 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R146 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R147 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R148 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R149 | RES MF 22K .25W 2% 100PPM | 24773-305R | K8996 | MR25 |
| R150 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R153 | RES MF 1K0 .25W 0.1% 15PPM | 24723-306P | K8479 | H8 |
| R154 | RES MF 22R .25W 2% 100PPM | 24773-233M | K8996 | MR25 |
| R155 | RV CERM 20R LI .5W 10% | 25711-633Y | U0914 | E2A |
| R156 | RES MF 294R .25W .1% 25PPM | 24723-412X | K8479 | H8 |
| R157 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R158 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R159 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R160 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R161 | RES CC 47R .125W 5% | 24331-975Y | U0914 | BB4705 |
| R162 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R163 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R164 | RV CERM 5K0 LI .5W 10% | 25711-640F | U0914 | E2A |
| R165 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R166 | RES MF 1K3 .25W 2% 100PPM | 24773-276E | K8996 | MR25 |
| R167 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R168 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R169 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R170 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R171 | RES MF 3K6 .25W 2% 100PPM | 24773-286G | K8996 | MR25 |
| R172 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R173 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R174 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R175 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R176 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R177 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R178 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R179 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | (Contd.) | | |
| R180 | RES CC 22R .125W 5% | 24331-988T | U0914 | BB2205 |
| R181 | RES MF 910R .25W 2% 100PPM | 24773-272K | K8996 | MR25 |
| R182 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R183 | RES MF 1K1 .25W 2% 100PPM | 24773-274Z | K8996 | MR25 |
| R184 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R185 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R186 | RES MF 180R .25W 2% 100PPM | 24773-255V | K8996 | MR25 |
| R187 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R188 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R189 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R190 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R191 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R192 | RES MF 560R .25W 2% 100PPM | 24773-267R | K8996 | MR25 |
| R193 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R194 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R195 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R196 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R197 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R198 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R199 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R200 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R201 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R202 | RV CERM 100K LI .5W 10% | 25711-644W | U0914 | E2A |
| R203 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R205 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R206 | RV THERM 470R 10% | 25685-402U | K8996 | 2332-642-62471 |
| R207 | RV CERM 500R LI .5W 10% | 25711-637F | U0914 | E2A |
| R208 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R209 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R210 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R211 | RES MF 1K2 .25W 2% 100PPM | 24773-275H | K8996 | MR25 |
| R212 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R213 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R214 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R215 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R216 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R217 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R218 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R219 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R220 | RES MF 200K .25W 2% 100PPM | 24773-328D | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD1** | **- Log amplifier** | (Contd.) | | |
| TR1 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR2 | TR NJF 2N4857 40V 40R 20MA | 28459-051X | K8996 | 2N4857 |
| TR3 | TR NJF 2N4857 40V 40R 20MA | 28459-051X | K8996 | 2N4857 |
| TR4 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR5 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR6 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR7 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR8 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR1 | TR PSI BCY71 45V 200M - GEN | 28435-235L | K8996 | BCY71 |
| TR11 | TR NSI 2N3904 40V 250M - GEN | 28454-786H | K5519 | 2N3904 |
| TR12 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR13 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR14 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR15 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR17 | TR PSI 2N3906 40V 250M - GEN | 28434-856A | K5519 | 2N3906 |
| TR18 | TR NSI 2N3904 40V 250M - GEN | 28454-786H | K5519 | 2N3904 |
| TR19 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR20 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR21 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR22 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR24 | TR PSI 2N3906 40V 250M - GEN | 28434-856A | K5519 | 2N3906 |
| TR25 | TR NSI 2N3904 40V 250M - GEN | 28454-786H | K5519 | 2N3904 |
| TR26 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR27 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR28 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR29 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| TR30 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| TR32 | TR PSI 2N3906 40V 250M - GEN | 28434-856A | K5519 | 2N3906 |
| TR33 | TR PSI 2N3906 40V 250M - GEN | 28434-856A | K5519 | 2N3906 |
| TR34 | TR NSI 2N3904 40V 250M - GEN | 28454-786H | K5519 | 2N3904 |
| TR35 | TR NSI BC209C 20V 150M - GEN | 28452-771P | K1196 | ZTX109CL (NLC) |
| TR36 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR37 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR38 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR39 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR40 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR41 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL08ORMPS4258 |
| T1 | TRANSFORMER | 43590-171E | | |
| T2 | TRANSFORMER | 43590-171E | | |
| T3 | TRANSFORMER | 43590-171E | | |
| T4 | TRANSFORMER | 43590-171E | | |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD2** | **- Log Amp Interface** | | | |
| 43. When ordering, prefix circuit reference with AD2 | | | | |
| | Complete unit | 44829-140D | U2632 | 44829-140D |
| C1 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| C2 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C3 | CAP CER 1N5 63V 10% | 26383-593A | K8996 | 630-18-152 |
| C4 | CAP CER 2.2P 63V .25P | 26343-457R | K8996 | 2222 682 |
| C5 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C6 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C7 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C8 | CAP ELEC 470N 50V 20% | 26421-104C | U4011 | K.47/50 |
| C9 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C10 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C11 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C12 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C13 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C14 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C15 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C16 | CAP ELEC 100U 35V 20%+ | 26421-122J | U4011 | CEB10035 |
| C17 | CAP PETP 220N 63V 10% | 26582-430L | K1945 | R68 D C 2203 AAK |
| C20 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C21 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C22 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C23 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C24 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C25 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C26 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C27 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C28 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C29 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C30 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C31 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C32 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C33 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C34 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C35 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C36 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C37 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C38 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C39 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD2** | **- Log Amp Interface** | (Contd.) | | |
| C40 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C41 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C42 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C43 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C44 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C45 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C46 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C47 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C48 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C49 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C50 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C51 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C52 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C53 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C54 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C55 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C56 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C57 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C58 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C59 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C60 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C61 | CAP CER 120P 63V 2% | 26343-478S | K8996 | 2222 682 |
| C62 | CAP CER 120P 63V 2% | 26343-478S | K8996 | 2222 682 |
| C63 | CAP CER 120P 63V 2% | 26343-478S | K8996 | 2222 682 |
| C64 | CAP ELEC 3U3 50V 20% | 26421-109Z | U4011 | K3.3/50 |
| C65 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| D1 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D4 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D6 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D8 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| IC1 | ICA SW DG211CJ QUAD CMOS ! | 28461-936E | K7068 | DG211CJ |
| IC2 | ICD MUX 74LS153 DUAL 4INP | 28469-711K | K5519 | SN74LS153N |
| IC3 | ICD NAND 74LS00 QUAD 2INP | 28466-345H | K5519 | SN74LS00N |
| IC4 | ICA AMP TL074CN QUAD FET I/P | 28461-349H | K5519 | TL074CN |
| IC5 | ICA AMP LF357N FET I/P LN DIL8 | 28461-356N | K7093 | LF357N |
| IC6 | ICD MONO 74LS122 RETR | 28468-310C | K5519 | SN74LS122N |
| IC8 | ICD FF-D 74LS74 DUAL +EDG TR | 28462-611A | K5519 | SN74LS74AN |
| IC9 | ICD DECOD 74LS42 4-10 | 28465-019U | K5519 | SN74LS42N |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AD2** | **- Log Amp Interface** | | (Contd.) | | |
| IC10 | ICD CTR 74LS192 DEC U/D SPEC | | 28464-128B | K5519 | SN74LS192N |
| IC11 | ICD CTR 74LS192 DEC U/D SPEC | | 28464-128B | K5519 | SN74LS192N |
| IC12 | ICA ADC AD578 12BIT 6US DIL32 | | 28461-928B | K7284 | AD578JNORAD578JD |
| IC13 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-611A | K5519 | SN74LS74AN |
| IC14,15 | PROGRAMMED PROM SET | ! | 44533-151V | U2632 | 44533-151V |
| IC16 | ICD NAND 74LS00 QUAD 2INP | | 28466-345H | K5519 | SN74LS00N |
| IC17 | ICD LATCH 74LS75 QUAD | | 28462-408U | K5519 | SN74LS75N |
| IC18 | ICD ADDER 74LS283 4BIT FULL | | 28469-397A | K5519 | SN74LS283N |
| IC19 | ICD SH-REG 74LS166 8BIT PISO | | 28467-523T | K5519 | SN74LS166N |
| IC20 | ICD SH-REG 74LS166 8BIT PISO | | 28467-523T | K5519 | SN74LS166N |
| IC21 | ICD ADDER 74LS283 4BIT FULL | | 28469-397A | K5519 | SN74LS283N |
| IC22 | ICD ADDER 74LS283 4BIT FULL | | 28469-397A | K5519 | SN74LS283N |
| IC23 | ICD AND 74LS08 QUAD 2INP | | 28466-012L | K5519 | SN74LS08N |
| IC24 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC30 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-611A | K5519 | SN74LS74AN |
| IC31 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-611A | K5519 | SN74LS74AN |
| IC32 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-611A | K5519 | SN74LS74AN |
| IC33 | ICD CTR 74LS161 4BIT BIN PRE | | 28464-118D | K5519 | SN74LS161AN |
| IC34 | ICD CTR 74LS161 4BIT BIN PRE | | 28464-118D | K5519 | SN74LS161AN |
| IC35 | ICD CTR 74LS161 4BIT BIN PRE | | 28464-118D | K5519 | SN74LS161AN |
| IC36 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC37 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC40 | ICD CTR 74LS161 4BIT BIN PRE | | 28464-118D | K5519 | SN74LS161AN |
| IC41 | ICD CTR 74LS161 4BIT BIN PRE | | 28464-118D | K5519 | SN74LS161AN |
| IC42 | ICD CTR 74LS161 4BIT BIN PRE | | 28464-118D | K5519 | SN74LS161AN |
| IC43 | ICD CTR 74LS193 4BIT BIN U/D | | 28464-126C | K5519 | SN74LS193N |
| IC44 | ICD CTR 74LS193 4BIT BIN U/D | | 28464-126C | K5519 | SN74LS193N |
| IC45 | ICD CTR 74LS193 4BIT BIN U/D | | 28464-126C | K5519 | SN74LS193N |
| IC46 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-611A | K5519 | SN74LS74AN |
| IC47 | ICM MP-SUP AM9513A TIM'G CTLR | ! | 28469-416G | U1458 | AM9513APC |
| IC50 | ICD INV 74LS04 HEX | | 28469-171L | K5519 | SN74LS04N |
| IC51 | ICD INV 74LS04 HEX | | 28469-171L | K5519 | SN74LS04N |
| IC52 | ICD NAND 74LS00 QUAD 2INP | | 28466-345H | K5519 | SN74LS00N |
| IC53 | ICD NAND 74LS00 QUAD 2INP | | 28466-345H | K5519 | SN74LS00N |
| IC54 | ICD OR 74LS32 QUAD 2INP | | 28466-108U | K5519 | SN74LS32N |
| IC55 | ICD OR 74LS32 QUAD 2INP | | 28466-108U | K5519 | SN74LS32N |
| IC56 | ICD AND 74LS08 QUAD 2INP | | 28466-012L | K5519 | SN74LS08N |
| IC57 | ICD NAND 74LS00 QUAD 2INP | | 28466-345H | K5519 | SN74LS00N |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLC | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLD | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD2** | **- Log Amp Interface** | | (Contd.) | |
| PLE | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLF | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLG | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAH | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAT | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R2 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R3 | RES MF 7K5 .25W 2% 100PPM | 24773-294T | K8996 | MR25 |
| R4 | RES MF 560R .25W 2% 100PPM | 24773-267R | K8996 | MR25 |
| R5 | RES MF 68K .25W 2% 100PPM | 24773-317N | K8996 | MR25 |
| R10 | RES MF 560R .25W 2% 100PPM | 24773-267R | K8996 | MR25 |
| R11 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R12 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R13 | RES MF 120K .25W 2% 100PPM | 24773-323F | K8996 | MR25 |
| R14 | RES MF 120K .25W 2% 100PPM | 24773-323F | K8996 | MR25 |
| R15 | RES MF 120K .25W 2% 100PPM | 24773-323F | K8996 | MR25 |
| R16 | RES MF 120K .25W 2% 100PPM | 24773-323F | K8996 | MR25 |
| R17 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R20 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R21 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R22 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R23 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R24 | RES MF 120K .25W 2% 100PPM | 24773-323F | K8996 | MR25 |
| R25 | RES MF 30K .25W 2% 100PPM | 24773-308A | K8996 | MR25 |
| R26 | RES MF 120K .25W 2% 100PPM | 24773-323F | K8996 | MR25 |
| R27 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R28 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R29 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R30 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R31 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R32 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R33 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R34 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R35 | RES MF 3K3 .25W 2% 100PPM | 24773-285F | K8996 | MR25 |
| R36 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R37 | RES MF 220K .25W 2% 100PPM | 24773-329T | K8996 | MR25 |
| R39 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R40 | RES MF 910R .25W 2% 100PPM | 24773-272K | K8996 | MR25 |
| R41 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R42 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R43 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R44 | RES MF 2K0 .25W 2% 100PPM | 24773-280U | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD2** | **- Log Amp Interface** | | (Contd.) | |
| R47 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R48 | RES MF 9K1 .25W 2% 100PPM | 24773-296X | K8996 | MR25 |
| R49 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| SK14 | S/C-ACC SKT DIL24 LOW PROFILE | 28488-044N | U2685 | 1824-AG-111D |
| SK15 | S/C-ACC SKT DIL24 LOW PROFILE | 28488-044N | U2685 | 1824-AG-111D |
| SK47 | S/C-ACC SKT DIL40 LOW PROFILE | 28488-046J | U2685 | 1840-AG-111D |
| TR1 | TR NJF BF245B 30V 6MA | 28459-048X | K8996 | BF245B |
| TR2 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD4** | **- 10 MHz Standard** | | | |
| 44. When ordering, prefix circuit reference with AD4 | | | | |
| | Complete unit | 44829-139P | U2632 | 44829-139P |
| C1 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C2 | CAP CER 1N5 63V 10% | 26383-593A | K8996 | 630-18-152 |
| C3 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C4 | CAP CER 1N5 63V 10% | 26383-593A | K8996 | 630-18-152 |
| C5 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C6 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C7 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C8 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C9 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C10 | CAP ELEC 33U 25V 20% | 26421-115U | U4011 | K33/25 |
| C11 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C12 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| C13 | CAP CER 10N 25V 20% | 26383-006C | K1439 | SDPN RF0605 |
| D1 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D2 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D3 | DI V/CAP BB405B 3V 11.5PF | 28381-101V | K8996 | BB405B |
| D4,5 | DI H/CARR HP5082-2080 SET OF 2 ! | 28349-012Y | K3464 | HP5082 2080 |
| D6 | DI ZEN BZX79C5V1 5.1V 5% | 28371-401U | K8996 | BZX79 C5V1 |
| D7 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| IC1 | ICD RX 75107A DUAL LINE TP | 28469-198Y | K5519 | MC75107ACP OR CL |
| IC2 | ICD NAND 74LS132 QUAD 2INP SCH | 28469-205N | K5519 | SN74LS132N |
| L1 | IND CHOKE 100UH 10% LAQ | 23642-561W | U4038 | SC10 37 |
| PLAA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAF | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RV CERM 500K LI 0.5W 10% | 25748-568D | U4736 | 175PCT504A |
| R2 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R3 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R4 | RES MF 330R .25W 2% 100PPM | 24773-261D | K8996 | MR25 |
| R5 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R6 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R7 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R8 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R9 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD4** | **- 10 MHz Standard** | (Contd.) | | |
| R10 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R11 | RES MF 1K6 .25W 2% 100PPM | 24773-278Y | K8996 | MR25 |
| R12 | RES MF 750R .25W 2% 100PPM | 24773-270R | K8996 | MR25 |
| R13 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| X1 | OSC XTAL 10MHZ O/T PLUG-IN | 28313-862L | K8996 | TCX04322 191 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD38** | **- Microprocessor** | | | |
| 45. When ordering, prefix circuit reference with AD38 | | | | |
| | Complete unit | 44828-535X | U2632 | 44828-535X |
| C1 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C2 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C3 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C4 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C5 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C6 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C7 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C8 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C9 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C10 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C11 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C12 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C13 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C14 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C15 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C16 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C17 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C18 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C19 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C20 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C21 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C22 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C23 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C24 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C25 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C26 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C27 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C28 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C29 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C30 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C31 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C32 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C33 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C34 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C35 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C36 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C37 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AD38** | **- Microprocessor** | | (Contd.) | | |
| C38 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C39 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C40 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C41 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C42 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C43 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C44 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C45 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C46 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C47 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C48 | CAP CER 10N 50V 20% | | 26346-120Y | U2109 | MA10 5C103 MAA |
| C60 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C61 | CAP CER 4N7 63V 10% | | 26383-591B | K8996 | 630-18-472 |
| C62 | CAP PETP 10N 63V 10% | | 26582-426N | K1945 | R68 D C 1002 AAK |
| C63 | CAP ELEC 10U 35V 20% | | 26421-112Z | U4011 | K10/35 |
| C64 | CAP ELEC 33U 25V 20% | | 26421-115U | U4011 | K33/25 |
| D1 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| D2 | DI H/CARR BAT29 5V | ! | 28349-014L | K6791 | BAT 29 OR BAR 35 |
| IC1 | ICD BUFF 74LS244 OCT 3ST | | 28469-182T | K5519 | SN74LS244N |
| IC2 | ICD AND 74LS08 QUAD 2INP | | 28466-012L | K5519 | SN74LS08N |
| IC3 | ICD NAND 74LS00 QUAD 2INP | | 28466-345H | K5519 | SN74LS00N |
| IC4 | ICD LATCH 74LS75 QUAD | | 28462-408U | K5519 | SN74LS75N |
| IC5 | ICD CTR 74LS90 4BIT DEC 2,5,10 | | 28464-014S | K5519 | SN74LS90N |
| IC6 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-611A | K5519 | SN74LS74AN |
| IC7 | ICD CTR 74LS93 4BIT BIN 2,8,16 | | 28464-117W | K5519 | SN74LS93N |
| IC8 | ICD DEC/DMX 74LS155 DUAL 2-4 | | 28465-026J | K5519 | SN74LS155N |
| IC9 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC10 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC11 | ICD LATCH 74LS373 OCT 3ST | | 28462-410E | K5519 | SN74LS373N |
| IC12 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC13 | ICD INV 74LS04 HEX | | 28469-171L | K5519 | SN74LS04N |
| IC14 | ICD CTR 74F161A 4BIT BIN PRE | ! | 28464-135H | K6659 | 74F161APC |
| IC15 | ICD BUFF 74LS244 OCT 3ST | | 28469-182T | K5519 | SN74LS244N |
| IC16 | ICD FF-D 74LS273 OCT +EDG TR | | 28462-615U | K5519 | SN74LS273N |
| IC17 | ICD FF-D 74LS74 DUAL +EDG TR | | 28462-611A | K5519 | SN74LS74AN |
| IC18 | ICM MP-SUP 8284A CLOCK GENR | | 28467-026Y | U4794 | UPB8284AC OR AD |
| IC19 | ICD OR 74LS32 QUAD 2INP | | 28466-108U | K5519 | SN74LS32N |
| IC20 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC21 | ICD BUFF 74LS245 OCT TXRX | | 28469-188B | K5519 | SN74LS245N |
| IC22 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC23 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC24 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |

| Circuit Ref. | Description | | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|---|
| **Board AD38** | **- Microprocessor** | | (Contd.) | | |
| IC25 | ICM MP 8088 16/8BIT HMOS | ! | 28467-024E | U1458 | P/D8088 |
| IC26 | ICM MP-SUP AM9513A TIM'G CTLR | ! | 28469-416G | U1458 | AM9513APC |
| IC27 | ICM MP-SUP 8251A USART DIL28 | ! | 28469-189K | U1458 | P8251A |
| IC28 | ICM MP-SUP 8259A PROG INT CTLR | ! | 28467-012X | K7664 | M5L8259AP |
| IC29 | ICM MP-SUP 8259A PROG INT CTLR | ! | 28467-012X | K7664 | M5L8259AP |
| IC30 | ICM MP-SUP 8259A PROG INT CTLR | ! | 28467-012X | K7664 | M5L8259AP |
| IC31 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC32 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC33 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC34 | ICD BUFF 74LS245 OCT TXRX | | 28469-188B | K5519 | SN74LS245N |
| IC35 | ICD LATCH 74LS373 OCT 3ST | | 28462-410E | K5519 | SN74LS373N |
| IC36 | ICD LATCH 74LS373 OCT 3ST | | 28462-410E | K5519 | SN74LS373N |
| IC37 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC38 | ICD DEC/DMX 74LS138 3-8 | | 28465-027F | K5519 | SN74LS138N |
| IC39 | ICM PROM X2816A 2KX8 EE DIL24 | ! | 28471-022V | 61394 | DQ2816A-250 |
| IC40 | ICM PROM X2816A 2KX8 EE DIL24 | ! | 28471-022V | 61394 | DQ2816A-250 |
| IC41-45 | PROGRAMMED EPROM SET | ! | 44533-206H | U2632 | 44533-206H |
| IC46 | ICM RAM HM6264P-15 8KX8 150NS | ! | 28469-312J | U4794 | UPD4464C-15 |
| IC47 | ICD MONO 74LS221 DUAL | | 28468-404D | K5519 | SN74LS221N |
| IC48 | ICD BUFF 74LS244 OCT 3ST | | 28469-182T | K5519 | SN74LS244N |
| PLH | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLJ | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLK | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLL | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLM | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLN | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLP | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLR | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLS | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLT | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAA | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAB | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAC | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAD | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAE | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAF | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAH | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLAT | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |
| PLFT | TERM C/PIN 0.64SQX6 S/E REEL | | 23435-188V | U2338 | 75401 001 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AD38** | **- Microprocessor** | | (Contd.) | |
| PLJA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLJB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLPS | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 200R .25W 2% 100PPM | 24773-256S | K8996 | MR25 |
| R2 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R3 | RES MF 5K1 .25W 2% 100PPM | 24773-290V | K8996 | MR25 |
| R4 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R5 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R6 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R7 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R9 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R10 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R11 | RES MF 22K .25W 2% 100PPM | 24773-305R | K8996 | MR25 |
| R15 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R16 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R18 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R20 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R21 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R22 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R23 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R24 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R30 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R31 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R32 | RES MF 4K7 .25W 2% 100PPM | 24773-289W | K8996 | MR25 |
| R33 | RES MF 270R .25W 2% 100PPM | 24773-259T | K8996 | MR25 |
| R34 | RES MF 270R .25W 2% 100PPM | 24773-259T | K8996 | MR25 |
| R35 | RES MF 270R .25W 2% 100PPM | 24773-259T | K8996 | MR25 |
| TR1 | TR PSI MPSL08 12V 700M - SW | 28431-767E | K5519 | MPSL080RMPS4258 |
| TR2 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |
| TR3 | TR NSI 2N2369 15V 500M - SW | 28452-197H | K5519 | 2N2369 OR A |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AE0** | **- Microwave Tray** | | | |
| 46. When ordering, prefix circuit reference with AE0 | | | | |
| | Complete unit | 44990-665P | U2632 | 44990-665P |
| C1 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C2 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C3 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C4 | CAP CER 22P 300V 10% | 26333-226Z | K8445 | FT73/29 |
| C5 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C6 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| C7 | CAP CER 1N0 300V 20%+ | 26373-733K | K8445 | FT73 29 K3000 |
| L1 | IND | 34900-918Y | U2632 | 34900-918Y |
| L2 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| L3 | IND CHOKE GEN | 44190-036B | U2632 | 44190-036B |
| PLEC | CON-RF SMB-MALE 50RR BKHD ELB | 23444-351P | K1072 | GE65209MBN |
| R1 | RES MF 13K .25W 2% 100PPM | 24773-300T | K8996 | MR25 |
| UT15 | Cable Assy | 43130-449C | U2632 | 43130-449C |
| UT16 | Cable Assy | 43130-450X | U2632 | 43130-450X |
| UT17 | Cable Assy | 43130-451M | U2632 | 43130-451M |
| UT18 | Cable Assy | 43130-452C | U2632 | 43130-452C |
| UT19 | Cable Assy | 43130-765A | U2632 | 43130-765A |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AE1** | **- 50 MHz Calibrator** | | | |
| 47. When ordering, prefix circuit reference with AE1 | | | | |
| | Complete unit | 44828-548U | U2632 | 44828-548U |
| C1 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C2 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C3 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C4 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C5 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C6 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C7 | CAP CER 18P 63V 2% | 26343-468Y | K8996 | 2222 682 |
| C8 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C9 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C10 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C11 | CAP CER 82P 63V 2% | 26343-476G | K6617 | EDPU |
| C12 | CAP CER 82P 63V 2% | 26343-476G | K6617 | EDPU |
| C13 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C14 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C15 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C16 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C17 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C18 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C19 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C20 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C21 | CAP CER 4N7 63V 10% | 26383-591B | K8996 | 630-18-472 |
| C22 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C23 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C24 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C25 | CAP CER 47N 25V 20% | 26383-017U | U4011 | ECK F1H473ZV |
| C26 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C27 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| C28 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C29 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C30 | CAP CER 3N3 63V 10% | 26383-589K | K8996 | 630-18-332 |
| D1 | DI PIN 5082-3379 50V ! | 28383-997T | K3464 | HP5082 3379 |
| D4 | DI ZEN 1N825/A 6.2V 5% | 28371-494Z | K8996 | 1N825 OR A |
| D5 | DI SIL BA482 35V JUNC | 28335-675R | K8996 | BA482 |
| D6 | DI SIL BA482 35V JUNC | 28335-675R | K8996 | BA482 |
| D7 | DI SIL BA482 35V JUNC | 28335-675R | K8996 | BA482 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AE1** | **- 50 MHz Calibrator** | (Contd.) | | |
| D8 | DI SIL BA482 35V JUNC | 28335-675R | K8996 | BA482 |
| IC1 | ICA AMP TL072CP DUAL FET I/P | 28461-348Z | K5519 | TL072CP |
| IC2 | ICA AMP TL072CP DUAL FET I/P | 28461-348Z | K5519 | TL072CP |
| IC3 | ICA VREG- LM337LZ ADJ .1A TO92 | 28461-748P | K5519 | LM337LZ |
| L1 | IND CHOKE 22UH 10% LAQ | 23642-557S | U4038 | SC10 29 |
| L2 | IND CHOKE .33UH 10% LAQ | 23642-546U | U4038 | SC10 07 |
| L3 | IND CHOKE .1UH 20% LAQ | 23642-543Z | U4038 | SC10 01 |
| L4 | IND CHOKE .22UH 10% LAQ | 23642-545E | U4038 | SC10 05 |
| L5 | IND CHOKE .1UH 20% LAQ | 23642-543Z | U4038 | SC10 01 |
| PLC | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLD | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R2 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R3 | RES MF 1K8 .25W 2% 100PPM | 24773-279N | K8996 | MR25 |
| R4 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R5 | RES MF 150R .25W 2% 100PPM | 24773-253F | K8996 | MR25 |
| R6 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R7 | RES MF 5K6 .25W 2% 100PPM | 24773-291S | K8996 | MR25 |
| R8 | RES MF 4K3 .25W 2% 100PPM | 24773-288S | K8996 | MR25 |
| R9 | RES MF 47R .25W 2% 100PPM | 24773-241A | K8996 | MR25 |
| R10 | RES MF 110R .25W 2% 100PPM | 24773-250N | K8996 | MR25 |
| R11 | RES MF 510R .25W 2% 100PPM | 24773-266C | K8996 | MR25 |
| R12 | RES MF 56R .25W 2% 100PPM | 24773-243H | K8996 | MR25 |
| R13 | RES MF 470R .25W 2% 100PPM | 24773-265M | K8996 | MR25 |
| R14 | RES MF 51R .25W 2% 100PPM | 24773-242Z | K8996 | MR25 |
| R15 | RES MF 10R .25W 2% 100PPM | 24773-225W | K8996 | MR25 |
| R16 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R17 | RES MF 1K0 .25W 2% 100PPM | 24773-273A | K8996 | MR25 |
| R18 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| R19 | RES MF 130R .25W 2% 100PPM | 24773-252J | K8996 | MR25 |
| R20 | RV CERM 50R LI .5W 10% | 25711-634N | U0914 | E2A |
| R21 | RES MF 4K3 .125W 2% 100PPM | 24772-088N | U0142 | CMF51 |
| R22 | RES MF 510R .125W 2% 100PPM | 24772-066W | U0142 | CMF51 |
| R23 | RES MF 4K3 .125W 2% 100PPM | 24772-088N | U0142 | CMF51 |
| R24 | RES MF 510R .125W 2% 100PPM | 24772-066W | U0142 | CMF51 |
| R25 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R26 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R27 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R28 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AE1** | **- 50 MHz Calibrator** | | (Contd.) | |
| R29 | RES MF 11K .25W 2% 100PPM | 24773-298C | K8996 | MR25 |
| R30 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R31 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R32 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R33 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R34 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R35 | RES MF 470K .25W 2% 100PPM | 24773-337R | U2453 | LR1 OR PR1 |
| R36 | RES MF 220K .25W 2% 100PPM | 24773-329T | K8996 | MR25 |
| R37 | RES MF 220K .25W 2% 100PPM | 24773-329T | K8996 | MR25 |
| R38 | RES MF 2K7 .25W 2% 100PPM | 24773-283L | K8996 | MR25 |
| R39 | RES MF 1K210 .25W .25% 15PPM | 24732-285M | K8479 | H8 |
| R40 | RV CERM 500K LI 0.5W 10% | 25748-568D | U4736 | 175PCT504A |
| R41 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R42 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| TR1 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR2 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR3 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR4 | TR NSI BFY90 15V 1G - AMP | 28452-157R | K8996 | BFY90 |
| TR5 | TR PSI BC308B 20V 130M - GEN | 28433-455R | K8300 | BC252B |
| UT1 | Cable Assy (AE1) | 43130-748S | U2632 | 43130-748S |
| X1 | DI H/CARR 5082-2080 SET OF 2 ! | 44529-103D | U2632 | 44529-103D |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AF0** | **- Front Panel** | | | |
| 48. When ordering, prefix circuit reference with AF0 | | | | |
| | Complete unit | 44990-669R | U2632 | 44990-669R |
| MP61 | CON-PART MIN HOUSING 1ROW 5P | 23435-168R | | |
| MP62 | CON-PART MIN HOUSING 1ROW 3P | 23435-171R | U2338 | MINI PV65039-034 |
| MP64 | CON-PART MIN POLARIZING KEY | 23435-190G | | |
| MP65 | CON-PART MIN SKT 22-26AWG REEL | 23435-178U | U2338 | MINI PV 47565 |
| MP66 | CON-PART MIN HOUSING 1ROW 4P | 23435-198M | | |
| SKK | CON MIN FEM 3 FXD SM3SN | 23427-124L | | |
| SKN | CON-RF BNC-FEM 50RR BKHD RG178 | 23443-548H | K1072 | GE35239 D24BN |
| UT12 | TRACKING GEN TO FRONT PANEL | 43129-919J | U2632 | 43129-919J |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AF1** | **- Front panel keyboard** | | | |
| 49. When ordering, prefix circuit reference with AF1 | | | | |
| | Complete unit | 44828-494D | U2632 | 44828-494D |
| C1 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C2 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C3 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C4 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C5 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| D1 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D2 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D4 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D5 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D7 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D8 | LAMP LED HLMP 1401 2.4V YELLOW | 28624-137D | K3464 | HLMP1401 |
| D9 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D10 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D11 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D12 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D13 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D14 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D15 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D16 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D17 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D18 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D19 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D20 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D21 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D22 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D23 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D24 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D25 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D26 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D27 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| D28 | LAMP LED HLMP 1503 3.0V GRN | 28624-138T | K3464 | HLMP1503 |
| IC1 | ICA COMP LM339N QUAD | 28461-693H | K5519 | LM339N |
| IC2 | ICA COMP LM339N QUAD | 28461-693H | K5519 | LM339N |
| IC3 | ICD ENCOD 74LS148 8INP PRIOR | 28465-024N | K5519 | SN74LS148N |
| IC4 | ICD ENCOD 74LS148 8INP PRIOR | 28465-024N | K5519 | SN74LS148N |
| IC5 | ICD NAND 74LS00 QUAD 2INP | 28466-345H | K5519 | SN74LS00N |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AF1** | **- Front panel keyboard** | | (Contd.) | |
| R1 | RES NET 4K7 2% 8DIL | 24681-519Z | U4736 | 761 3 |
| R2 | RES NET 220R 2% 8DIL | 24681-501F | U4736 | 761 3 |
| R3 | RES MF 15K 1/4W 2% 100PPM | 24681-301P | | |
| R4 | RES MF 220R .25W 2% 100PPM | 24773-257W | K8996 | MR25 |
| R5 | RES NET 4K7 5% 8DIL | 24681-519Z | U4736 | 761 3 |
| R6 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R7 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| SAA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SAB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SAC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SAJ | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SAL | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SBA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SBB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SBC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SBD | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SBE | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SBH | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SBJ | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SCA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SCB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SCC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SCD | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SCE | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SCH | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SCJ | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDD | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDE | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDH | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDJ | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SDL | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SEA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SEB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SEC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SED | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SEE | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SHA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SHB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AF1** | **- Front panel keyboard** (Contd.) | | | |
| SHC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SJA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SJB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SJC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SJD | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SJE | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SJH | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SJJ | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SLA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SLB | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SLC | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| SMA | SW PUSH 1CO 24V 10MA | 23465-411B | U2361 | BODY SERU |
| X7 | SW-CAP RECT BK "+" (1 of 5) | 37590-932V | U2632 | 37590-932V |
| X8 | SW-CAP RECT BK "+" (1 of 5) | 37590-933S | U2632 | 37590-933S |
| X14 | SW-CAP RECT BK "REF FREQ" | 37590-946K | U2632 | 37590-946K |
| X15 | SW-CAP RECT BK "INC FREQ" (1 of 2) | 37590-947A | U2632 | 37590-947A |
| X16 | SW-CAP RECT BK "REF LEVEL" | 37590-927F | U2632 | 37590-927F |
| X17 | SW-CAP RECT BK "PEAK FIND" | 37590-952H | U2632 | 37590-952H |
| X18 | SW-CAP RECT BK "INTMD IDENT" | 37590-953E | U2632 | 37590-953E |
| X19 | SW-CAP RECT BK "A B SELECT" | 37590-954U | U2632 | 37590-954U |
| X20 | SW-CAP RECT BK "A B SELECT" | 37590-954U | U2632 | 37590-954U |
| X21 | SW-CAP RECT BK "VIDEO" | 37590-625W | U2632 | 37590-625W |
| X22 | SW-CAP RECT BK "EXT" | 37590-626D | U2632 | 37590-626D |
| X23 | SW-CAP RECT BK "SINGLE ARM" | 37590-956N | U2632 | 37590-956N |
| X24 | SW-CAP RECT BK "LINE" | 37590-957L | U2632 | 37590-957L |
| X25 | SW-CAP RECT BK "AUTO" | 37590-958J | U2632 | 37590-958J |
| X26 | SW-CAP RECT BK "NORM" | 37590-959F | U2632 | 37590-959F |
| X27 | SW-CAP RECT BK "LOG" | 37590-960L | U2632 | 37590-960L |
| X28 | SW-CAP RECT BK "2" | 37590-963G | U2632 | 37590-963G |
| X29 | SW-CAP RECT BK "1" | 37590-962F | U2632 | 37590-962F |
| X30 | SW-CAP RECT BK "5" | 37590-964V | U2632 | 37590-964V |
| X31 | SW-CAP RECT BK "0.5" | 37590-961J | U2632 | 37590-961J |
| X32 | SW-CAP RECT BK "VOLTS /DIV" | 37590-966W | U2632 | 37590-966W |
| X33 | SW-CAP RECT BK "10" | 37590-965S | U2632 | 37590-965S |
| X34 | SW-CAP RECT BK "TRACK GEN" | 37591-226F | | |
| X35 | SW-CAP RECT BK "FULL SPAN" | 37590-968T | U2632 | 37590-968T |
| X36 | SW-CAP RECT GRN "PRESET" | 37591-237X | | |
| X37 | SW-CAP RECT BK "MKR1" | 37590-970D | U2632 | 37590-970D |
| X38 | SW-CAP RECT BK "MKR2" | 37590-971T | U2632 | 37590-971T |
| X39 | SW-CAP RECT BK "FREQ COUNT" | 37590-972P | U2632 | 37590-972P |
| X40 | SW-CAP RECT BK "ZERO SPAN" | 37590-973X | U2632 | 37590-973X |
| X41 | SW-CAP RECT BK "/DIV" | 37590-974M | U2632 | 37590-974M |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AF1** | **- Front panel keyboard** | | (Contd.) | |
| X42 | SW-CAP RECT BK "AUTO TRIG" | 37590-975C | U2632 | 37590-975C |
| X43 | SW-CAP RECT BK "1 2 MOVE" | 37590-976R | U2632 | 37590-976R |
| X44 | SW-CAP RECT BK "START" | 37590-977B | U2632 | 37590-977B |
| X45 | SW-CAP RECT BK "METER" | 37590-978K | U2632 | 37590-978K |
| X100 | CABLE RIBBBON (AF1-AF2) | 43129-963D | U2632 | 43129-963D |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AF2** | **- Front panel logic** | | | |
| 50. When ordering, prefix circuit reference with AF2 | | | | |
| | Complete unit | 44828-495T | U2632 | 44828-495T |
| C1 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C2 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C3 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C4 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C5 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C6 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C7 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C8 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C9 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C10 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C11 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C12 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C13 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C14 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C15 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C16 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C17 | CAP ELEC 1U0 50V 20% | 26421-106B | U4011 | K1.0/50 |
| C18 | CAP CER 220P 63V 2% | 26343-481S | K8996 | 2222 682 |
| C19 | CAP CER 220P 63V 2% | 26343-481S | K8996 | 2222 682 |
| C20 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C21 | CAP CER 2N2 63V 10% | 26383-587R | K8996 | 630-18-222 |
| C22 | CAP ELEC 100N 50V 20% | 26421-100T | U4011 | K 0.1/50 |
| C23 | CAP ELEC 100N 50V 20% | 26421-100T | U4011 | K 0.1/50 |
| C24 | CAP CER 1N0 63V 10% | 26383-585M | K8996 | 630-18-102 |
| IC1 | ICD FF-D 74LS374 OCT +E TR 3ST | 28462-618L | K5519 | SN74LS374N |
| IC2 | ICD FF-D 74LS273 OCT +EDG TR | 28462-615U | K5519 | SN74LS273N |
| IC3 | ICD FF-D 74LS273 OCT +EDG TR | 28462-615U | K5519 | SN74LS273N |
| IC4 | ICD FF-D 74LS273 OCT +EDG TR | 28462-615U | K5519 | SN74LS273N |
| IC5 | ICD FF-D 74LS273 OCT +EDG TR | 28462-615U | K5519 | SN74LS273N |
| IC6 | ICD BUFF 74LS244 OCT 3ST | 28469-182T | K5519 | SN74LS244N |
| IC7 | ICD ENCOD 74LS348 8INP PRTY TS | 28465-028G | K0461 | SN74LS348N |
| IC8 | ICD FF-D 74LS74 DUAL +EDG TR | 28462-611A | K5519 | SN74LS74AN |
| IC9 | ICD MONO 74LS221 DUAL | 28468-404D | K5519 | SN74LS221N |
| IC10 | ICD MONO 74LS221 DUAL | 28468-404D | K5519 | SN74LS221N |
| IC11 | ICD NAND 74LS00 QUAD 2INP | 28466-345H | K5519 | SN74LS00N |
| IC12 | ICD NAND 74LS00 QUAD 2INP | 28466-345H | K5519 | SN74LS00N |
| IC13 | ICD MONO 74LS123 DUAL RETR | 28468-309B | K5519 | SN74LS123N |
| IC14 | ICD XOR 74LS86 QUAD 2INP | 28466-406C | K5519 | SN74LS86N |
| IC15 | ICD FF-D 74LS74 DUAL +EDG TR | 28462-611A | K5519 | SN74LS74AN |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AF2** | **- Front panel logic** | | (Contd.) | |
| R1 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R2 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R3 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R4 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R5 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R6 | RES MF 360R .25W 2% 100PPM | 24773-262T | K8996 | MR25 |
| R7 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R8 | RES MF 360R .25W 2% 100PPM | 24773-262T | K8996 | MR25 |
| R9 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R10 | RES NET 300R 2% 8SINGLE DIL | 24681-513M | U4736 | 761 3 |
| R11 | RES NET 300R 2% 8SINGLE DIL | 24681-513R | U4736 | 761 3 |
| R12 | RES NET 300R 2% 8SINGLE DIL | 24681-513R | U4736 | 761 3 |
| R13 | RES MF 15K .25W 2% 100PPM | 24773-301P | K8996 | MR25 |
| R15 | RES MF 6K8 .25W 2% 100PPM | 24773-293D | K8996 | MR25 |
| R16 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R20 | RES MF 2K2 .25W 2% 100PPM | 24773-281Y | K8996 | MR25 |
| R21 | RES MF 560R .25W 2% 100PPM | 24773-267R | K8996 | MR25 |
| R22 | RES MF 560R .25W 2% 100PPM | 24773-267R | K8996 | MR25 |
| R23 | RES NET 300R 2% 8SINGLE DIL | 24681-513R | U4736 | 761 3 |
| R24 | RES WW 120R 1.5W 5% | 25123-052F | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AG1** | **- Input Switch** | | | |
| 51. | When ordering, prefix circuit reference with AG1 | | | |
| | Complete unit | 44338-120H | U2632 | 44338-120H |
| **Unit AG2** | **- 4-section Attenuator** | | | |
| 52. | When ordering, prefix circuit reference with AG2 | | | |
| | Complete unit | 44429-031Y | U2632 | 44429-031Y |
| **Unit AG3** | **- Power Protection Pick-off Assembly** | | | |
| 53. | When ordering, prefix circuit reference with AG3 | | | |
| | Complete unit | 44990-672R | U2632 | 44990-672R |
| **Unit AH0** | **- Receiver & 2nd LO Assembly** | | | |
| 54. | When ordering, prefix circuit reference with AH0 | | | |
| | Complete unit | 44990-666X | U2632 | 44990-666X |
| **Unit AJ0** | **- 1st LO Assembly** | | | |
| 55. | When ordering, prefix circuit reference with AJ0 | | | |
| | Complete unit | 44990-667M | U2632 | 44990-667M |
| **Unit AK0** | **- Tracking Generator Assembly** | | | |
| 56. | When ordering, prefix circuit reference with AK0 | | | |
| | Complete unit | 44990-668C | U2632 | 44990-668C |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AM0** | **- Basic Module** | | | |
| 57. When ordering, prefix circuit reference with AM0 | | | | |
| | Complete unit | 44990-707R | U2632 | 44990-707R |
| MP6 | CABLE ASSY | 43129-957V | U2632 | 43129-957V |
| MP7 | CABLE ASSY | 43129-958S | U2632 | 43129-958S |
| MP8 | CABLE ASSY | 43129-959W | U2632 | 43129-959W |
| UT9 | TRACKING GEN TO ATTENUATOR | 43129-917N | U2632 | 43129-917N |
| UT10 | TRACKING GEN 550MHZ CABLE | 43129-921L | U2632 | 43129-921L |
| UT11 | TRACKING GEN 500-900MHZ CABLE | 43129-923F | U2632 | 43129-923F |
| UT12 | Cable Assy | 43130-661B | U2632 | 43130-661B |
| UT13 | Cable Assy | 43130-662K | U2632 | 43130-662K |
| UT14 | Cable Assy | 43130-665H | U2632 | 43130-665H |
| UT15 | Cable Assy | 43130-663A | U2632 | 43130-663A |
| UT16 | Cable Assy | 43130-740U | U2632 | 43130-740U |
| UT17 | Cable Assy | 43130-520X | U2632 | 43130-520X |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AR0** | **- Rear Panel** | | | |
| 58. When ordering, prefix circuit reference with AR0 | | | | |
| | Complete unit | 44990-670M | U2632 | 44990-670M |
| LS1 | LOUDSPEAKER ROUND 75R 2.25" | 23646-105A | S4248 | 6A1 70 |
| MP60 | CON-PART MIN SKT 22-26AWG REEL | 23435-178U | U2338 | MINI PV 47565 |
| MP61 | CON-PART MIN HOUSING 1ROW 5P | 23435-168R | | |
| MP62 | CON-PART MIN POLARIZING KEY | 23435-190G | | |
| MP72 | FAN ACC FILTER FOR 23535-123 | 23535-110L | U3329 | LZ60 |
| MP73 | FAN AX 24V DC BRUSHLESS 119MM | 23535-123X | U3329 | 4124GX/DCM4EARTH |
| R1 | RV CERM 10K LI 2W 10% | 25737-003S | U0914 | 70B1G032L103W |
| R2 | RV CERM 10K LI 2W 10% | 25737-002V | U0914 | 70N1G032L103W |
| SKK | CON-PART MIN HOUSING 1ROW 3P | 23435-171R | U2338 | MINI PV65039-034 |
| SKM | CON-PART MIN HOUSING 1ROW 6P | 23435-992C | | |
| SKU | CON TEL FEM 2 FXD GREY | 23421-683Z | K1310 | R326.400.25 |
| UT4 | Plug Assy (Data Termination) | 43149-019Y | U2632 | 43149-019Y |
| UT5 | Cable Assy | 43130-247B | U2632 | 43130-247B |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AR1** | **- Signal Interface** | | | |
| 59. When ordering, prefix circuit reference with AR1 | | | | |
| | Complete unit | 44829-451P | U2632 | 44829-451P |
| C1 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C2 | CAP PETP 470N 63V 10% | 26582-427L | K1945 | R68 D C 4703 AAK |
| C3 | CAP ELEC 4U7 35V 20% | 26421-108A | U4011 | K4.7/35 |
| C4 | CAP ELEC 4U7 35V 20% | 26421-108A | U4011 | K4.7/35 |
| C5 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C6 | CAP CER 10N 50V 20% | 26346-120Y | U2109 | MA10 5C103 MAA |
| C7 | CAP TANT 15U 16V 20% | 26486-227B | U3613 | SH |
| D1 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D3 | DI CUR-REG J505 50V 1.0MA TO92 | 28383-986L | K7068 | J505 |
| IC1 | ICA AMP LF357N FET I/P LN DIL8 | 28461-356N | K7093 | LF357N |
| IC2 | ICA COMP LM339N QUAD | 28461-693H | K5519 | LM339N |
| IC3 | ICA AMP TL071CP FET I/P DIL8 | 28461-347A | K5519 | TL071CP |
| IC4 | ICD BUFF 74LS126A QUAD 3ST | 28469-101U | K5519 | SN74LS126AN |
| IC5 | MOD OPTO CNX38 ISOL 1K5V | 28625-007Y | K8996 | CNX38 |
| IC6 | MOD OPTO CNX38 ISOL 1K5V | 28625-007Y | K8996 | CNX38 |
| MP2 | CON-PART D SCREWLOCK FEM | 23435-981V | K0316 | D20418 2 |
| MP5 | S/C-ACC PAD TO18,ETC TO .1"GRD | 28488-115L | K1935 | TO18-019D |
| PLA | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLB | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLT | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAD | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAR | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 1R0 .25W 2% 100PPM | 24773-201M | U1395 | RC55 |
| R2 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R3 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R4 | RES MG 10M .25W 5% | 24321-885W | K8996 | VR25 |
| R5 | RES MF 27K .25W 2% 100PPM | 24773-307K | K8996 | MR25 |
| R6 | RES MF 82R .25W 2% 100PPM | 24773-247N | K8996 | MR25 |
| R7 | RES MF 2K2 .25W 2% 100PPM | 24773-281Y | K8996 | MR25 |
| R8 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R9 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R10 | RES MF 300K .25W 2% 100PPM | 24773-332T | K8996 | MR25 |
| R11 | RES MF 390R .25W 2% 100PPM | 24773-263P | K8996 | MR25 |
| R12 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AR1** | **- Signal Interface** | (Contd.) | | |
| R13 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R14 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R15 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R18 | RES MF 33K .25W 2% 100PPM | 24773-309Z | K8996 | MR25 |
| R19 | RES MF 100K .25W 2% 100PPM | 24773-321L | K8996 | MR25 |
| R20 | RES MF 1M0 .25W 2% 100PPM | 24773-346E | U2453 | LR1 OR PR1 |
| R21 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R22 | RES MF 18K .25W 2% 100PPM | 24773-303M | K8996 | MR25 |
| R24 | RES MF 820R .25W 2% 100PPM | 24773-271B | K8996 | MR25 |
| R25 | RES MF 1K5 .25W 2% 100PPM | 24773-277U | K8996 | MR25 |
| R26 | RES MF 10K .25W 2% 100PPM | 24773-297M | K8996 | MR25 |
| R27 | RES MF 39K .25W 2% 100PPM | 24773-311A | K8996 | MR25 |
| SKS | CON D FEM 25 FXD PCB STRT | 23435-508P | K0316 | DB 25SOL2 |
| TR1 | TR NMF VN10KM 60V 5R0 - VMOS ! | 28459-046T | U5008 | VN 10 KM |
| TR2 | TR PSI BC307A 45V 130M - GEN | 28435-227H | K6360 | BC307A |
| TR3 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |
| TR4 | TR NSI BC237A 45V 150M - GEN | 28455-421X | K1196 | ZTX107AL |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AR2** | **- Power Supply Interface** | | | |
| 60. When ordering, prefix circuit reference with AR2 | | | | |
| | Complete unit | 44828-541R | U2632 | 44828-541R |
| C1 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C2 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C3 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C4 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C5 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C6 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C7 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C8 | CAP TANT 10U 35V 20% | 26486-225C | K4701 | 199D |
| C9 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C10 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C11 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C12 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C13 | CAP TANT 15U 16V 20% | 26486-227B | U3613 | SH |
| C14 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C15 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C16 | CAP ELEC 1000U 35V 20%+ | 26421-130W | K8996 | 035 90006 |
| C17 | CAP PETP 100N 63V 10% | 26582-429F | K1945 | R68 D C 1003 AAK |
| C18 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| C19 | CAP ELEC 10U 35V 20% | 26421-112Z | U4011 | K10/35 |
| D1 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D2 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D3 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D4 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D5 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D6 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D7 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D8 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D9 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D10 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D11 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D12 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| D13 | DI RECT 1N4004 400V | 28357-028K | K8996 | 1N4004 |
| D15 | DI SIL 1N4148 75V JUNC | 28336-676J | K8996 | 1N4148 |
| FS1 | FUSE Q/ACT 3.15A 20X5 | 23411-008L | K0647 | S500 OR TDC13 |
| IC1 | ICA VREG+ LM317T ADJ 1.5A | 28461-726A | K5519 | LM317T |
| IC2 | ICA VREG+ LM317T ADJ 1.5A | 28461-726A | K5519 | LM317T |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Board AR2** | **- Power Supply Interface** (Contd.) | | | |
| IC3 | ICA VREG+ LM317T ADJ 1.5A | 28461-726A | K5519 | LM317T |
| IC4 | ICA VREG- LM337T ADJ 1.5A | 28461-727Z | K5519 | LM337T |
| IC5 | ICA VREG- LM337T ADJ 1.5A | 28461-727Z | K5519 | LM337T |
| IC6 | ICA VREG- LM337T ADJ 1.5A | 28461-727Z | K5519 | LM337T |
| L2 | IND RF 320uH | 44190-038A | U2632 | 44190-038A |
| L4 | Ind Choke 170uH | 44190-055V | U2632 | 44190-055V |
| L5 | Ind Choke 170uH | 44190-055V | U2632 | 44190-055V |
| MP5 | H/W FUSE CARRIER OPEN 20X5 | 23416-151D | U0154 | L1426 |
| MP8 | CON-PART D SCREWLOCK FEM | 23435-981V | K0316 | D20418 2 |
| PLE | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLF | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLH | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLK | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLV | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLX | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| PLAG | TERM C/PIN 0.64SQX6 S/E REEL | 23435-188V | U2338 | 75401 001 |
| R1 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R2 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R3 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R4 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R5 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R6 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R8 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R10 | RES MF 47K .25W 2% 100PPM | 24773-313H | K8996 | MR25 |
| R15 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R16 | RES MF 3K0 .25W 2% 100PPM | 24773-284J | K8996 | MR25 |
| R17 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R18 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R19 | RES MF 2K4 .25W 2% 100PPM | 24773-282N | K8996 | MR25 |
| R20 | RES MF 100R .25W 2% 100PPM | 24773-249J | K8996 | MR25 |
| R21 | RES MF 240R .25W 2% 100PPM | 24773-258D | K8996 | MR25 |
| R22 | RES MF 750R .25W 2% 100PPM | 24773-270R | K8996 | MR25 |
| R25 | RV CERM 500R LI .5W 10% | 25711-604J | U0914 | E4A |
| R26 | RV CERM 500R LI .5W 10% | 25711-604J | U0914 | E4A |
| R27 | RV CERM 100R LI .5W 10% | 25711-608S | U0914 | E4A |
| SKP | CON D FEM 37 FXD PCB STRT | 23435-509X | K0316 | DC 37SOL2 |
| SKV | CON JUMP FEM 2 9.6MM | 23435-990X | U2338 | 65474 001 |
| TR2 | TR NSI TIP112 100V 5M DAR | 28457-822L | K5519 | TIP112 |
| X1 | CORE BEAD 5X.7X10LG 3S2 | 23635-811Z | K8996 | FX4015 |
| X2 | CORE BEAD 5X.7X10LG 3S2 | 23635-811Z | K8996 | FX4015 |

| Circuit Ref. | Description | MI Part No. | Mfr. Code | Mfr. Part No. |
|---|---|---|---|---|
| **Unit AZ1** | **- Optical Encoder Assembly** | | | |
| 61. When ordering, prefix circuit reference with AZ1 | | | | |
| | Complete unit | 44990-455W | U2632 | 44990-455W |
| **Board AZ2** | **- Sweep span switch** | | | |
| 62. When ordering, prefix circuit reference with AZ2 | | | | |
| | Complete unit | 44828-498M | U2362 | 44828-498M |

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## MISCELLANEOUS MECHANICAL PARTS

63. Order without prefix

| Fig. 1 Ref. | Description | Part Number |
|---|---|---|
| 1 | Top cover | 35905-964T |
| 2 | Bottom cover | 35905-965P |
| 3 | Front panel, marked | 35903-571L |
| 4 | Front trim | 34900-477G |
| 5 | Front infill | 35903-724X |
| 6 | Clip (1 of 2) | 35905-963D |
| 7 | Rear panel | 35903-500E |
| 8 | Trim, rear | 34900-470E |
| 9 | Knob assembly 32.0 mm 6.0 I/D | 41149-067C |
| 10 | Knob assembly 31.0 mm 4.0 I/D (2 off) | 41149-068R |
| | Knob cap (3 off) | 37590-282D |
| 11 | Panel handle | 41700-382P |
| 12 | Infill | 35902-386W |
| 13 | Foot plastic black 0.75 mm O/D (4 off) | 22315-663B |
| 14 | Foot ring (2 off) | 33901-451H |
| 15 | Foot rear, left hand (from front) | 34900-864T |
| 16 | Foot rear, right hand (from front) | 34900-863D |
| 17 | Toggle latch | 22315-116K |
| 18 | Side rail (2 off) | 34900-476F |
| 19 | End cap (2 off) | 37590-255C |
| 20 | End cap (2 off) | 37590-256R |
| 21 | Handle, PVC (2 off) | 22315-590M |
| 22 | Handle, steel (4 off) | 22315-587M |
| 23 | Cap, moulded (4 off) | 37590-257B |
| 24 | Liner | 22315-584T |

(To be issued later)

Fig. 1 Miscellaneous mechanical parts

TABLE 1 - MANUFACTURERS' CODES TO NAMES AND ADDRESSES

| NATO Mfr. Code | Manufacturers Address |
|---|---|
| 06665 | PRECISION MONOLITHICS INC, SUB OF BOURNS INC, 1500 SPACE PARK DR, SANTA CLARA, CA95050, |
| 15542 | MINI-CIRCUITS LABORATORY, DIV SCIENTIFIC COMPONENTS CORP, 2625 E 14TH ST, BROOKLYN, NY11235, |
| 61394 | SEEQ TECHNOLOGY INC, 1849 FORTUNE DR, SAN JOSE, CA95131, USA, |
| K0066 | OXLEY DEVELOPMENTS CO LTD, PRIORY PARK, ULVERSTON, CUMBRIA, LA12 9QG |
| K0099 | JACKSON BROS (LONDON) LTD, KINGSWAY WADDON, CROYDEN, SURREY, CR9 4DG |
| K0142 | SALFORD ELECTRICAL INSTRUMENTS LTD, NEWHAVEN INDUSTRIAL ESTATE, BARTON LANE, ECCLES, MANCHESTER, M30 0HL |
| K0316 | ITT CANNON UK, JAYS CLOSE, VIABLES IND EST, BASINGSTOKE, HANTS, RG22 4BW |
| K0461 | TEXAS INSTRUMENTS LTD, MANTON LANE, BEDFORD, MK41 7PA |
| K0647 | BESWICK A DIVISION OF DUBILIER PLC, ALERT WORKS, FROME, SOMERSET, BA11 1PP |
| K0718 | BECKMAN INSTRUMENTS LTD, GLENROTHES, FIFE, SCOTLAND, KY7 5PU |
| K1072 | GREENPAR CONNECTORS LTD, PO BOX 15, HARLOW, ESSEX, CM20 2ER |
| K1196 | FERRANTI LTD ELECTRONICS DIVISION, GEM MILL, CHADDERTON, OLDHAM, LANCS, OL9 8NP |
| K1310 | WKR LTD, RENDAR DIVISION, DURBAN ROAD, SOUTH BERSTED, BOGNOR REGIS, WEST SUSSEX, PO22 9RL |
| K1439 | STETTNER (DE) STEATITE ROEDERSTEIN LTD, HAGLEY HOUSE, 83 HAGLEY ROAD, BIRMINGHAM, B16 8QW |
| K1935 | JERMYN INDUSTRIES LTD, VESTRY ESTATE, VESTRY ROAD, SEVENOAKS, KENT, TN14 5EU |
| K1945 | ARCOTRONICS (SCOTLAND) LTD, WHITESIDE WORKS, BATHGATE, WEST LOTHIAN, EH48 2RL |
| K3464 | HEWLETT-PACKARD LTD, ESKDALE ROAD, WINNERSH TRIANGLE, WOKINGHAM, BERKS, RG11 5DZ |
| K3921 | VITRAMON LTD, WYCOMBE LANE, WOOBURN GREEN, BUCKS, HP10 0HH |
| K4184 | ELECTROSIL DIVISION CORNING LTD, PO BOX 37, PALLION TRAD EST, SUNDERLAND, TYNE & WEAR, SR4 6SU |
| K4642 | LCR COMPONENTS, CROSS STREET, TREDEGAR, GWENT, NP2 6HA |

TABLE 1 (Contd.)

| NATO Mfr. Code | Manufacturers Address |
|---|---|
| K4701 | SPRAGUE ELECTRIC (UK) LTD, AIRTECH 2, GENNER ROAD OFF FLEMING WAY, CRAWLEY, WEST SUSSEX, RH10 2YG |
| K5519 | MOTOROLA (UK SALES) LTD, MOTOROLA SEMI-CON PRODUCTS GRP, FAIRFAX HOUSE, 69 BUCKINGHAM STREET, AYLESBURY BUCKS, HP20 2NF |
| K5743 | BOURNS ELECTRONICS LTD, HODFORD HOUSE, 27 HIGH STREET, HOUNSLOW, MIDDLESEX, TW3 1TE |
| K6360 | SIEMENS LTD ELECTRONIC COMPONENTS GROUP, SIEMENS HOUSE, WINDMILL ROAD, SUNBURY ON THAMES, MIDDLESEX, TW16 7HS |
| K6617 | AEG (UK) LTD, 217 BATH ROAD, SLOUGH, BERKS, SL1 4FW |
| K6659 | FAIRCHILD SEMI CONDUCTOR LTD, 230 HIGH STREET, POTTERS BAR, HERTS, EN6 5BL |
| K6791 | THOMSON CSF COMPONENTS & MATERIALS LTD, RINGWAY HOUSE, BELL ROAD, DANESHILL, BASINGSTOKE HANTS, RG24 0QG |
| K7068 | SILICONIX LTD, LLANLLIENWEN CLOSE, MORRISTON, SWANSEA, SA6 6NE |
| K7093 | NATIONAL SEMI CONDUCTOR (UK) LTD, 301 HARPUR CENTRE, HORNE LANE, BEDFORD, MK40 1TR |
| K7284 | ANALOG DEVICES LTD, CENTRAL AVENUE, EAST MOLESEY, SURREY, KT8 0SN |
| K7584 | PHILIPS ELECTRONIC & ASSOC. INDS. LTD, ARUNDEL GT COURT, 8 ARUNDEL STREET, LONDON, WC2R 3DT |
| K7664 | MITSUBISHI CORPORATION, BOW BELLS HOUSE, BREAD STREET, LONDON, EC4N 9BJ |
| K8283 | ASHCROFT ELECTRONICS LTD, 1 WILKINSON ROAD, CIRENCESTER, GLOS, GL7 1YT |
| K8300 | STANDARD TELEPHONE & CABLES LTD, CHRISTCHURCH WAY, GREENWICH, LONDON, SE10 0AG |
| K8445 | MIDLAND CAPACITORS LTD, 46 CHURCH STREET, COGENHOE, NORTHAMPTON, NN7 1LS |
| K8479 | HOLSWORTHY ELECTRONICS LTD, NORTH ROAD, HOLSWORTHY, DEVON, EX22 6JE |
| K8996 | MULLARD LTD, MULLARD HOUSE, TORRINGTON PLACE, LONDON, WC1E 7HD |
| S4284 | FOSTER ELECTRIC CO, 512 NIYAZAWA´CHO, AKISHIMA´CITY, TOKIO, JAPAN |
| U0142 | DALE-ACI COMPONENTS LTD, SOLWAY IND ESTATE, MARYPORT, CUMBRIA, CA15 8NF |

TABLE 1 (Contd.)

| NATO Mfr. Code | Manufacturers Address |
|---|---|
| U0154 | BELLING LEE LTD, INTEC HOUSE, 540 GREAT CAMBRIDGE ROAD, ENFIELD, MIDDLESEX, EN1 3RY |
| U0914 | GENERAL HYBRID LTD, BEDE INDUSTRIAL EST, JARROW, TYNE & WEAR, NE32 3EN |
| U1395 | WELWYN ELECTRONICS LTD, RESOLUTE ELECTRONICS DIV, BEDLINGTON, NORTHUMBERLAND, NE22 7AA |
| U1458 | ADVANCED MICRO DEVICES (UK) LTD, AMD HOUSE, GOLDSWORTH ROAD, WOKING, SURREY, GU21 1JT |
| U2109 | AVX LTD, THAMES WORKS LWR TEDDINGTON RD, HAMPTON WICK, NR KINGSTON UPON THAMES, SURREY, KT1 4HA |
| U2338 | DUPONT (UK) LTD (BERG ELECTRONICS DIV), WEDGEWOOD WAY, STEVENAGE, HERTS, SG1 4QN |
| U2361 | ITT SWITCHES (UK) LTD, THE MILL HOUSE, BARRY AVENUE, WINDSOR, SL4 1QS |
| U2453 | NEOHM, ITALIA HOUSE, PASS STREET, WERNETH, OLDHAM LANCS, OL9 6HZ |
| U2475 | ECC ELECTRONICS (UK) LTD, UNIT 9, BLENHEIM ROAD, HIGH WYCOMBE, BUCKS, HP12 3RT |
| U2632 | MARCONI INSTRUMENTS SERVICE DIVISION, THE AIRPORT, LUTON, BEDS, LU2 9NS |
| U2685 | AUGAT INTERCONNECTION COMPONENTS LTD, SUNRISE PARKWAY, LINFORD WOOD EAST, MILTON KEYNES, BUCKS, MK14 6LF |
| U3329 | PAPST MOTORS LTD, PARNALL COURT, EAST PORTWAY, ANDOVER, HANTS, SP10 3LX |
| U3418 | RAYTHEON SEMI CONDUCTOR INTERNATL CO LTD, HARREM HOUSE, OGILVIE ROAD, HIGH WYCOMBE, BUCKS, HP12 3DS |
| U3613 | MATSUSHITA ELECTRONICS COMPONENTS co.LTD, NATIONAL PANASONICS (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS, SL1 6JB |
| U3967 | BELL ELECTRONICS, EASTERN ROAD, ALDERSHOT, HANTS, GU12 4TD |
| U4011 | WIMPEY DUBILIER LTD, CHAUCER TRADING ESTATE, LAUNTON ROAD, BICESTER, OXON, OX6 0TU |
| U4038 | SIGMEX LTD, SIGMA HOUSE, NORTH HEATH LANE, HORSHAM, SUSSEX, RH12 4UZ |
| U4251 | MIDLAND ROSS LTD, GRIMES DIVISION, DUKESBRIDGE CHAMBERS, 1 DUKE STREET, READING BERKS, RG1 4LN |

TABLE 1 (Contd.)

| NATO Mfr. Code | Manufacturers Address |
|---|---|
| U4736 | AB ELECTRONIC EQUIP LTD, IVER ROAD, SHEFFIELD, BEDS, SG17 5JU |
| U4794 | NEC ELECTRONICS (UK) LTD, SYGNES HOUSE, SUNRISE PARKWAY, MILTON KEYNES, MK14 6NP |
| U5008 | POWER PRODUCTS INTERNATIONAL LTD, COMMERCE WAY, EDENBRIDGE, KENT, TN8 6ED |

# Chapter 7

## SERVICING DIAGRAMS

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Para.
1 Circuit notes
1 Component values
3 Symbols

| Fig. | Unit | Title | Page |
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| 2 | AA2 | 502.6 MHz amplifier | |
| | AA3 | 502.6 MHz band-pass filter | |
| | AA3a | 3rd mixer | 9/10 |
| 3 | AA4 | 550 MHz buffer | |
| | AA4a | Translation loop mixer | 11/12 |
| 4 | AA5 | Translation oscillator | |
| | AA6a | Cavity oscillator | |
| | AA6b | Cavity oscillator p.c.b. | 13/14 |
| 5 | AA6 | Cavity oscillator buffer | |
| | AA12 | Divide by 16 | 15/16 |
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| | AA10/1 | 550 MHz phase detector | 23/24 |
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| 22 | AC1 | 50 MHz crystal oscillator | 49/50 |
| 23 | AC2 | 47.4 MHz i.f. amplifier | 51/52 |
| 24 | AC3 | 2.6 MHz LC filter | 53/54 |
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| 31 | AD0 | AD tray interconnections | 67/68 |
| 32 | AD1 | Log amplifier | 69/70 |
| 33 | " | " " | 71/72 |
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| 35 | " | " " " | 75/76 |
| 36 | " | " " " | 77/78 |
| 37 | " | " " " | 79/80 |
| 38 | AD4 | 10 MHz standard | 81/82 |
| 39 | AD38 | Microprocessor | 83/84 |
| 40 | " | " " | 85/86 |
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| 42 | " | " " | 89/90 |
| 43 | AE0 | AE tray interconnections | 91/92 |
| 44 | AE1 | 50 MHz calibrator | 93/94 |
| 45 | AF0 | Front panel interconnections | 95/96 |
| 46 | AF1 | Front panel keyboard | 97/98 |
| 47 | AF2 | Front panel logic | |
| | AZ1 | Optical encoder | |
| | AZ2 | Sweep span switch | 99/100 |
| 48 | AF2 | Front panel logic | 101/102 |
| 49 | AG1 | Input switch | |
| | AG2 | Input attenuator | |
| | AG3 | Power protection pick-off assembly | 103/104 |
| 50 | AH1 | Mixer voltage limiter | 105/106 |
| 51 | AH2 | Input filter and 1st mixer | 107/108 |
| 52 | AH3 | Directional filter | 109/110 |
| 53 | AH4 | 4.9 GHz i.f. amplifier | 111/112 |
| 54 | AH5 | 2nd mixer | 113/114 |
| 55 | AH8 | 2nd l.o. multiplier driver | |
| | AH9 | 2nd l.o. multiplier | 115/116 |
| 56 | AH11 | 2nd l.o. power splitter | 117/118 |
| 57 | AH12 | Receiver p.s.u. distribution | 119/120 |
| 58 | " | " " " | 121/122 |
| 59 | AJ1 | 1st l.o. power splitter | 123/124 |
| 60 | AJ3 | 1st l.o. power splitter | 125/126 |
| 61 | AJ4/1 | 1st l.o. sampling gate | |
| | AJ5 | Sampling gate driver | 127/128 |
| 62 | AJ6/1 | YTO driver | |
| | AJ7 | YTO | 129/130 |
| 63 | AJ8 | 1st l.o. bias board | 131/132 |
| 64 | AK0 | Tracking generator assembly | 133/134 |
| 65 | AK1 | Calibrator levelling detector | 135/136 |
| 66 | AK2 | Calibrator isolation switch | 137/138 |
| 67 | AK3 | TG switch and detector | 139/140 |
| 68 | AK4 | TG output amplifier | 141/142 |
| 69 | AK5 | TG output mixer and l.p. filter | 143/144 |
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| Fig. | Unit | Title | Page |
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| 72 | AK11 | 502.6 MHz levelling loop | 149/150 |
| 73 | AK12 | 502.6 MHz v.c.o. | 151/152 |
| 74 | AK13 | 502.6 MHz phase detector | 153/154 |
| 75 | AK14 | TG supply distribution | 155/156 |
| 76 | " | " " " | 157/158 |
| 77 | AL1/2 | 1st l.o. amplifier | 159/160 |
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| 79 | AR0 | Rear panel interconnections | 163/164 |
| 80 | AR1 | Signal interface | 165/166 |
| 81 | AR2 | Power supply interface | 167/168 |
| 82 | AT1 | Input switch p.c.b. | 169/170 |
| 83 | AT2 | 4-section attenuator | 171/172 |

## CIRCUIT NOTES

### Component values

1. Resistors : Code letter R = ohms, k = kilohms ($10^3$), M = megohms ($10^6$).

   Capacitors : Code letter m = millifarads ($10^{-3}$), μ = microfarads ($10^{-6}$).

   n = nanofarads ($10^{-9}$), p = picofarads ($10^{-12}$).

   Inductors : Code letter H = henrys, m = millihenrys ($10^{-3}$).

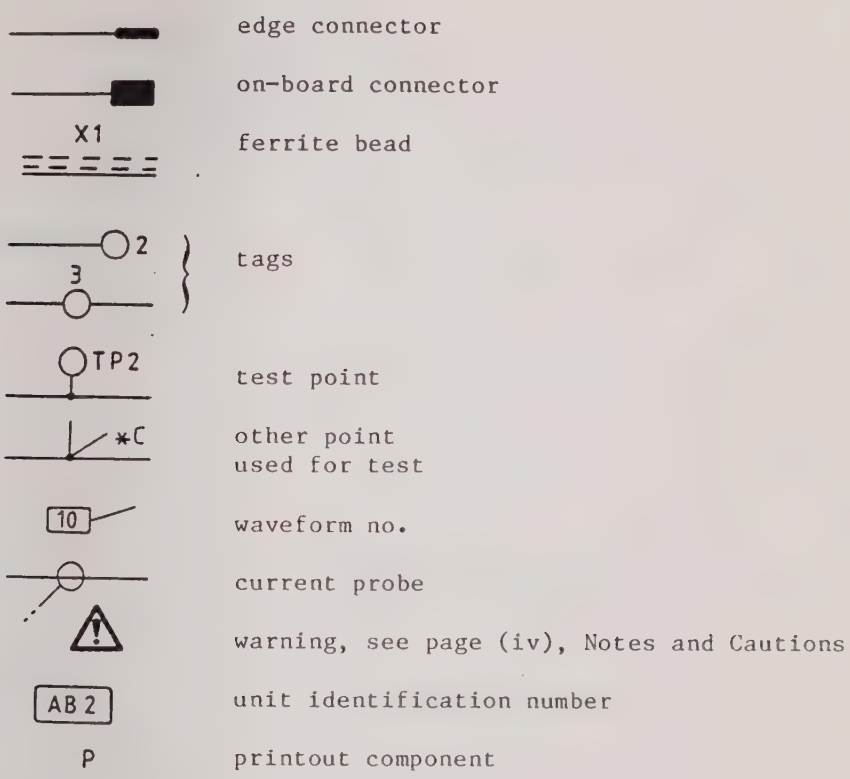
   μ = microhenrys ($10^{-6}$), n = nanohenrys ($10^{-9}$).

   SIC : value selected during test, nominal value shown.

2. Components are marked normally with two, three or four figures according to the accuracy limit ±10%, ±1% or ±0.1%. The code letter used indicates the multiplier and replaces the decimal point. Because a marking 4m7 could be interpreted as milliohms, millifarads or millihenrys each value is placed near to its related symbol.

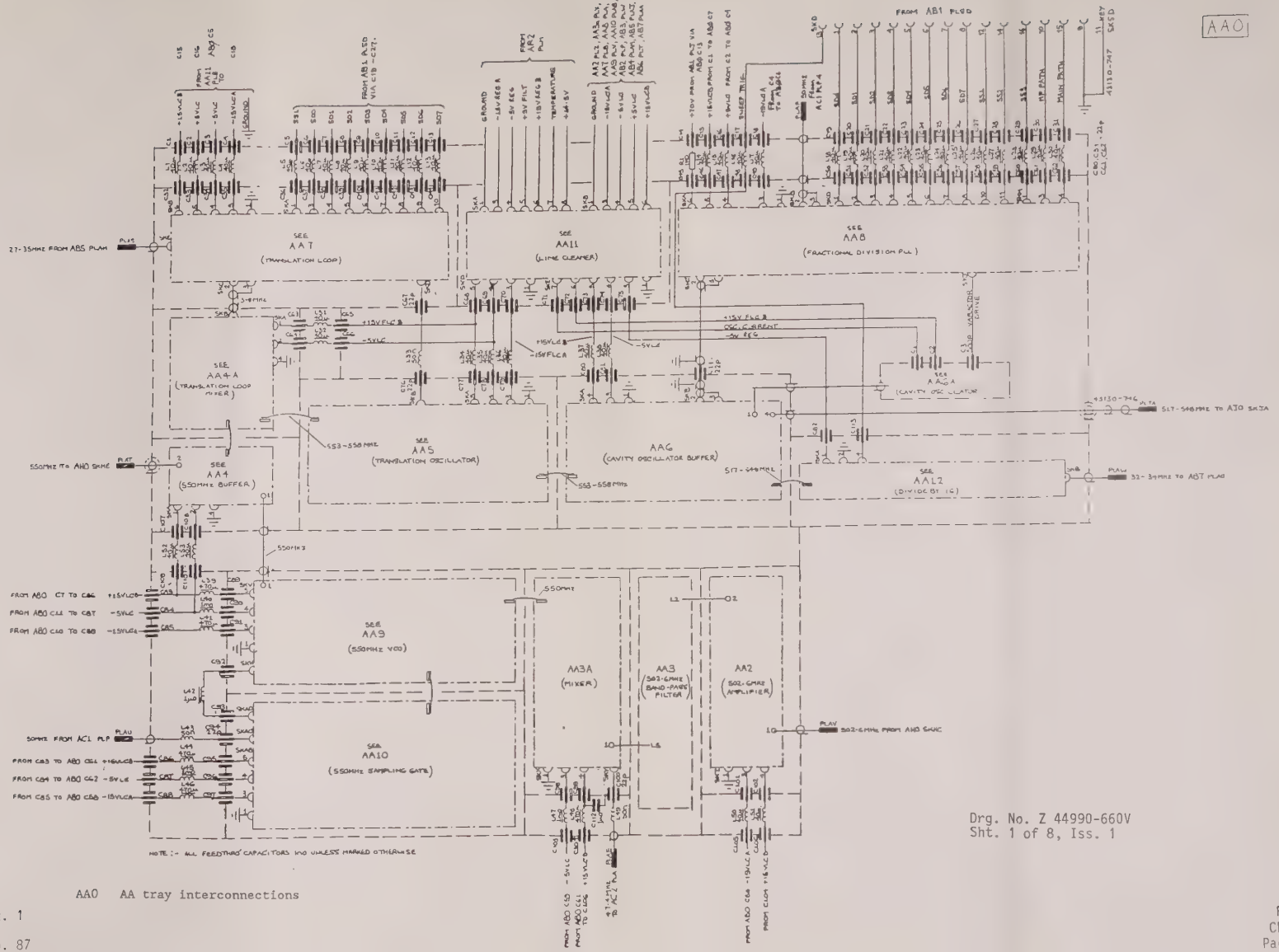
## Symbols

3. Symbols are based on the provisions of BS 3939 with the following additions:




4. Electro-mechanical relays are all shown according to convention, in the de-energized state with all power supplies removed.

AA0

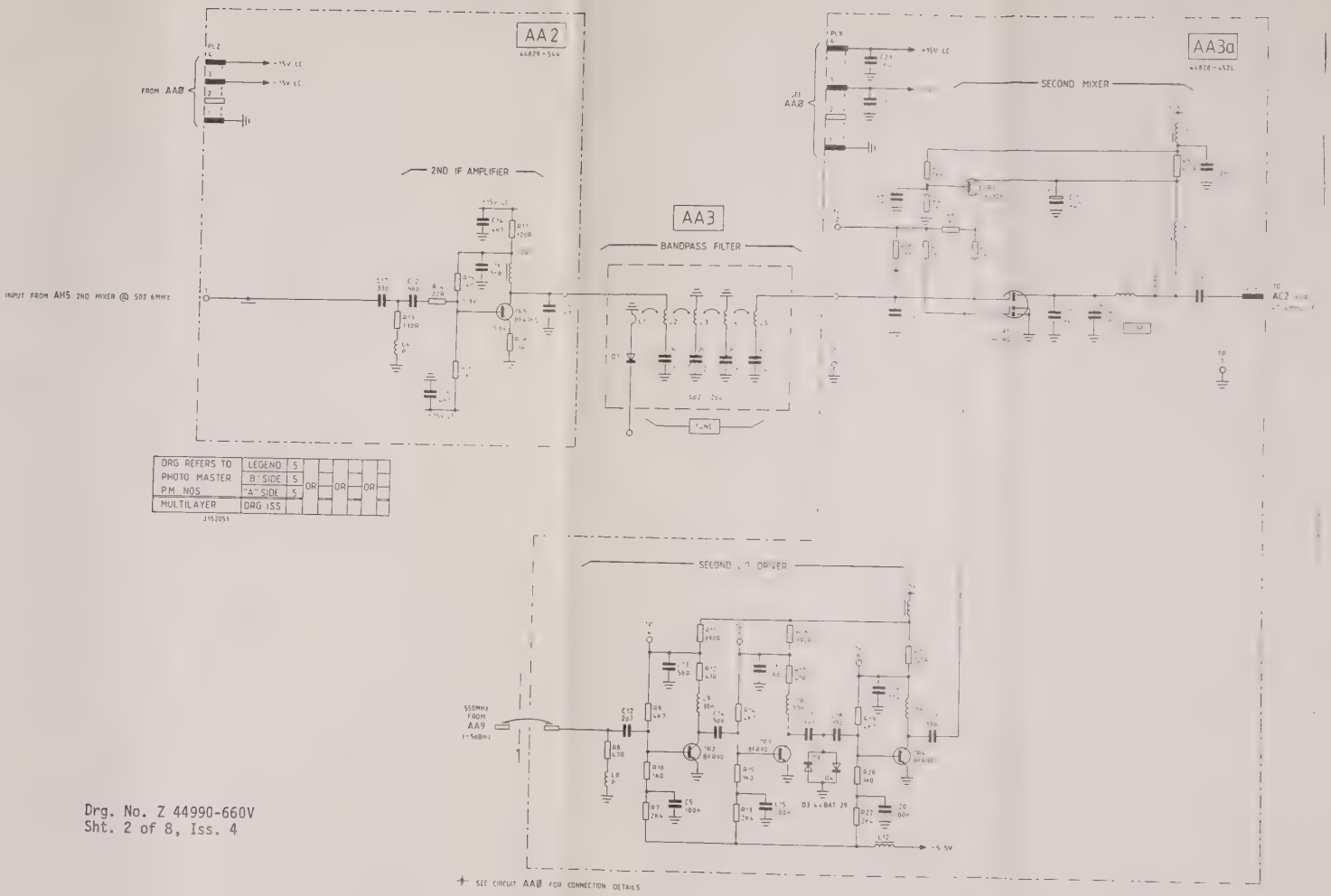



AA0 AA tray interconnections

Drg. No. Z 44990-660V
Sht. 1 of 8, Iss. 1

Fig. 1

Sep. 87

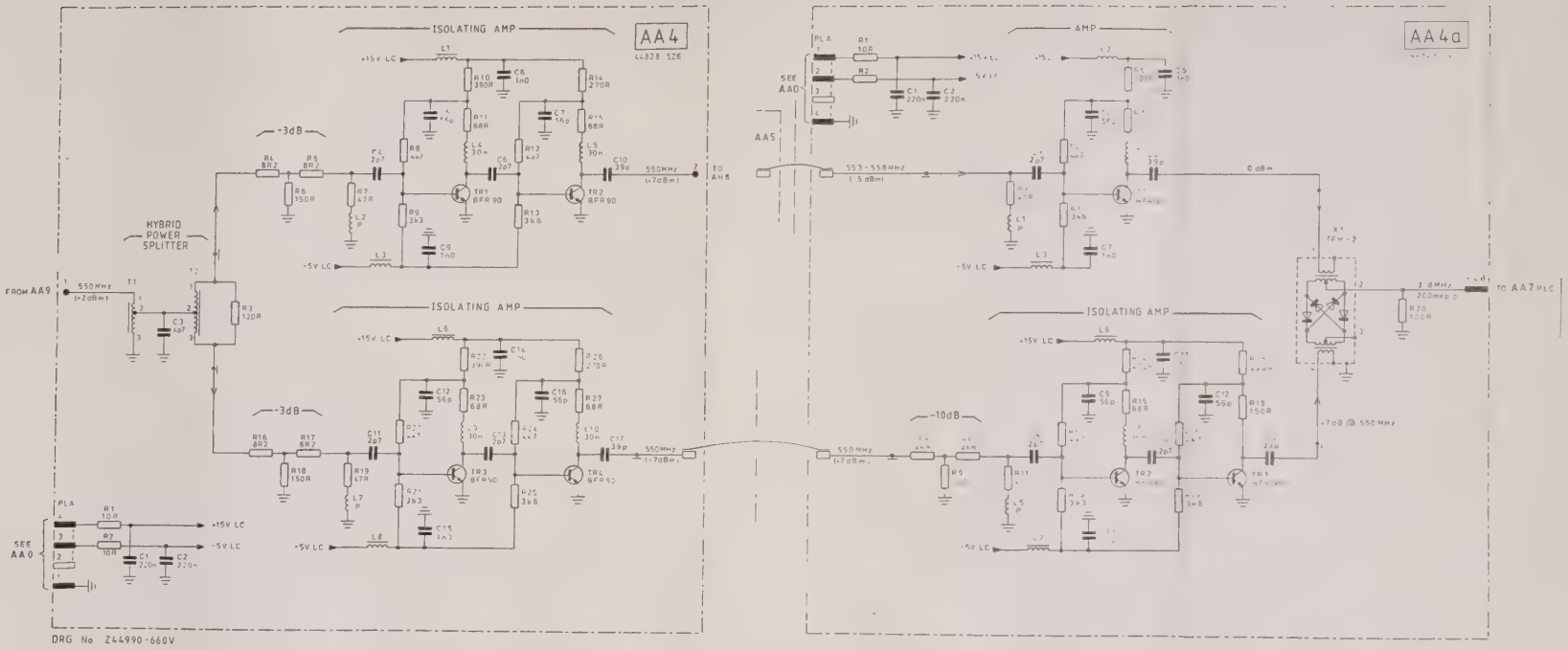



| | | | | | |
|---|---|---|---|---|---|
| DRG REFERS TO | LEGEND | S | OR | OR | OR |
| PHOTO MASTER | B SIDE | S | | | |
| P.M. NOS | "A" SIDE | S | | | |
| MULTILAYER | DRG ISS. | | | | |

J152053

Drg. No. Z 44990-660V
Sht. 2 of 8, Iss. 4

AA2 502.6 MHz amplifier
AA3 502.6 MHz band-pass filter
AA3a 3rd mixer




| DRG REFERS TO | LEGEND | 6 | | | | |
|---|---|---|---|---|---|---|
| PHOTO MASTER | 'B' SIDE | 6 | OR | OR | OR | |
| P.M Nos | 'A' SIDE | 6 | | | | |
| MULTILAYER | DRG. ISS | | | | | |

| DRG REFERS TO | LEGEND | | 2 | | | |
|---|---|---|---|---|---|---|
| PHOTO MASTER | 'B' SIDE | | 2 | OR | OR | |
| P.M Nos | 'A' SIDE | | 2 | | | |
| MULTILAYER | DRG. ISS | | | | | |

Drg. No. Z 44990-660V
Sht. 3 of 8, Iss. 1

Fig. 3

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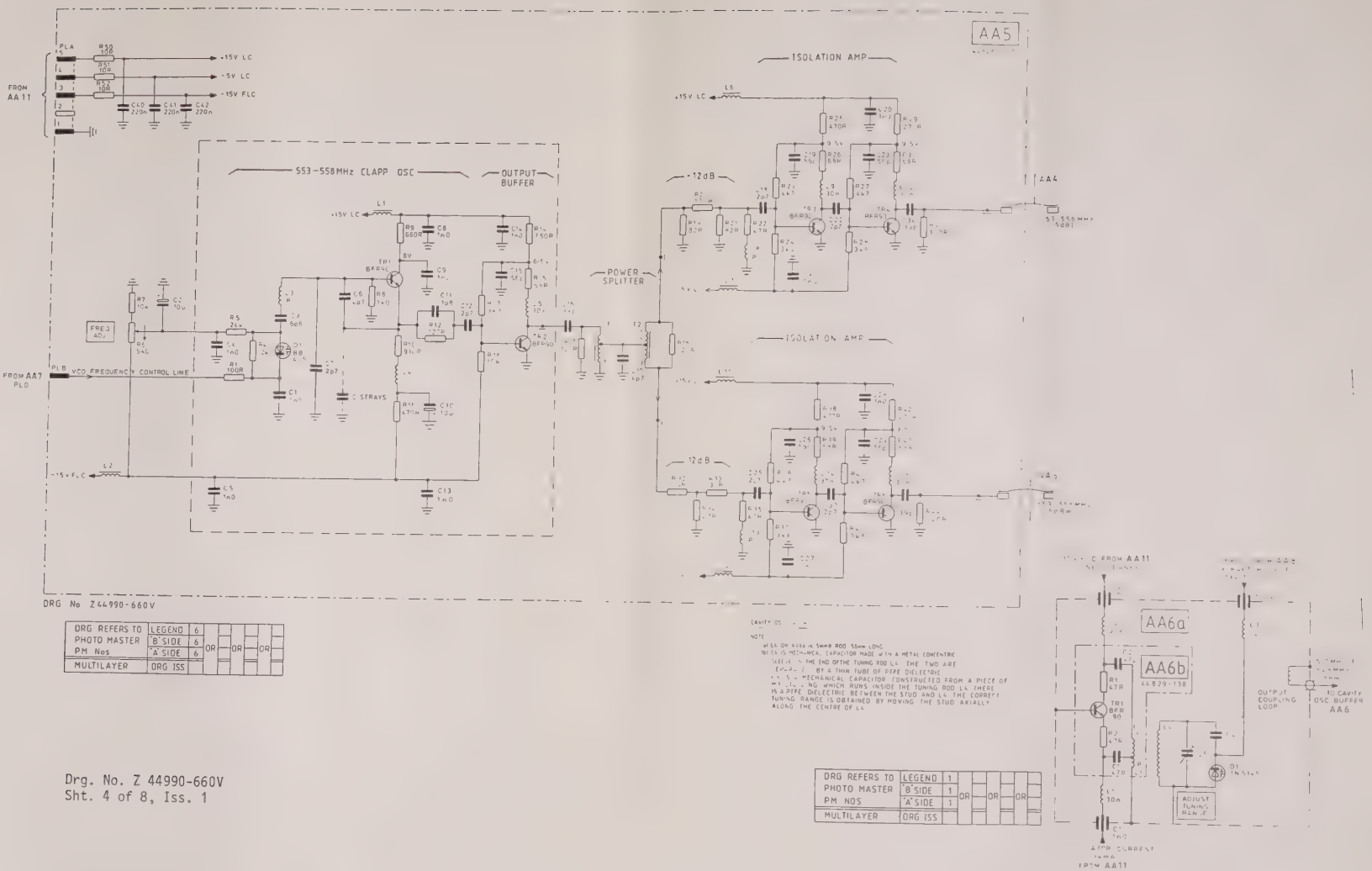
AA4 550 MHz buffer
AA4a Translation loop mixer




| DRG REFERS TO PHOTO MASTER PM Nos | LEGEND | | OR | | OR | | OR | |
|---|---|---|---|---|---|---|---|---|
| | 'B' SIDE | 6 | | | | | | |
| | 'A' SIDE | 6 | | | | | | |
| MULTILAYER | DRG ISS | | | | | | | |

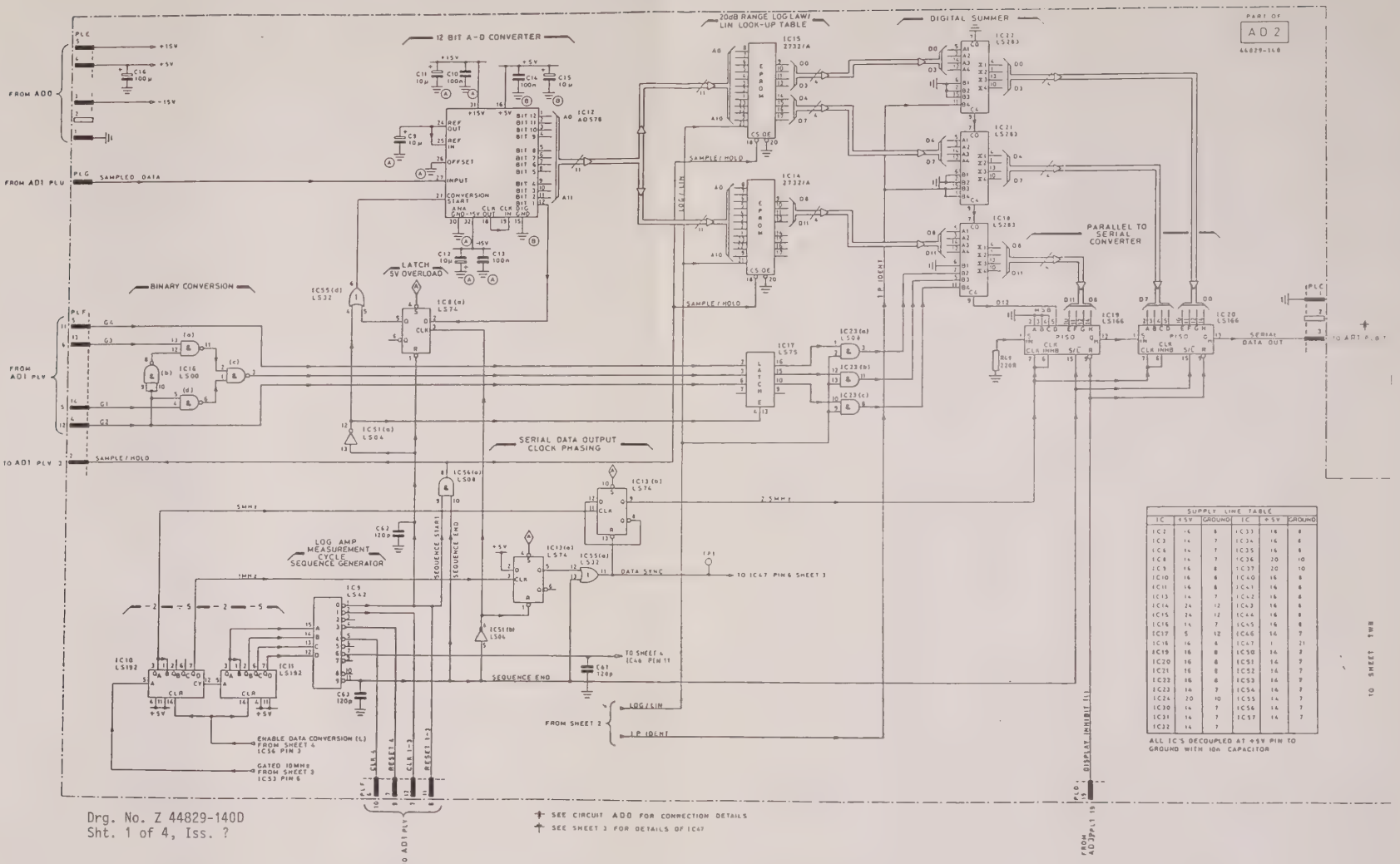
| DRG REFERS TO PHOTO MASTER PM NOS | LEGEND | | OR | | OR | | OR | |
|---|---|---|---|---|---|---|---|---|
| | 'B' SIDE | 1 | | | | | | |
| | 'A' SIDE | 1 | | | | | | |
| MULTILAYER | DRG ISS | | | | | | | |

Drg. No. Z 44990-660V
Sht. 4 of 8, Iss. 1

Fig. 4

Sep. 87

AA5 Translation oscillator
AA6a Cavity oscillator
AA6b Cavity oscillator p.c.b.

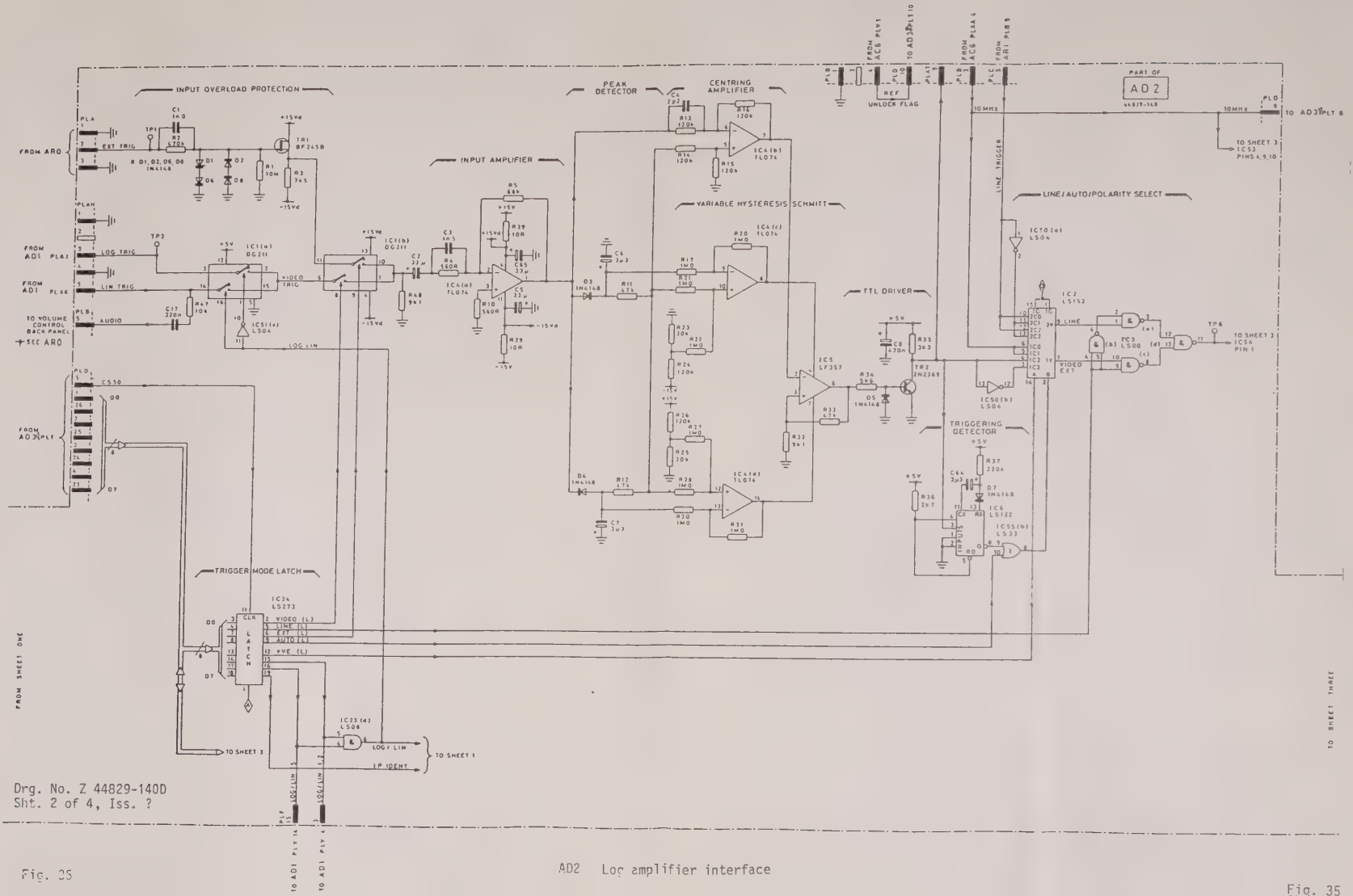



SUPPLY LINE TABLE

| IC | +5V | GROUND | IC | +5V | GROUND |
|---|---|---|---|---|---|
| IC2 | 14 | 7 | IC33 | 16 | 8 |
| IC3 | 14 | 7 | IC34 | 16 | 8 |
| IC4 | 14 | 7 | IC35 | 16 | 8 |
| IC8 | 14 | 7 | IC36 | 20 | 10 |
| IC9 | 16 | 8 | IC37 | 20 | 10 |
| IC10 | 16 | 8 | IC40 | 16 | 8 |
| IC11 | 16 | 8 | IC41 | 16 | 8 |
| IC13 | 14 | 7 | IC42 | 16 | 8 |
| IC14 | 24 | 12 | IC43 | 16 | 8 |
| IC15 | 24 | 12 | IC44 | 16 | 8 |
| IC16 | 14 | 7 | IC45 | 16 | 8 |
| IC17 | 5 | 12 | IC46 | 16 | 7 |
| IC18 | 16 | 8 | IC47 | 1 | 21 |
| IC19 | 16 | 8 | IC50 | 16 | 7 |
| IC20 | 16 | 8 | IC51 | 16 | 7 |
| IC21 | 16 | 8 | IC52 | 16 | 7 |
| IC22 | 16 | 8 | IC53 | 16 | 7 |
| IC23 | 16 | 7 | IC54 | 16 | 7 |
| IC24 | 20 | 10 | IC55 | 14 | 7 |
| IC30 | 14 | 7 | IC56 | 14 | 7 |
| IC31 | 14 | 7 | IC57 | 14 | 7 |
| IC32 | 14 | 7 | | | |

Drg. No. Z 44829-140D
Sht. 1 of 4, Iss. ?

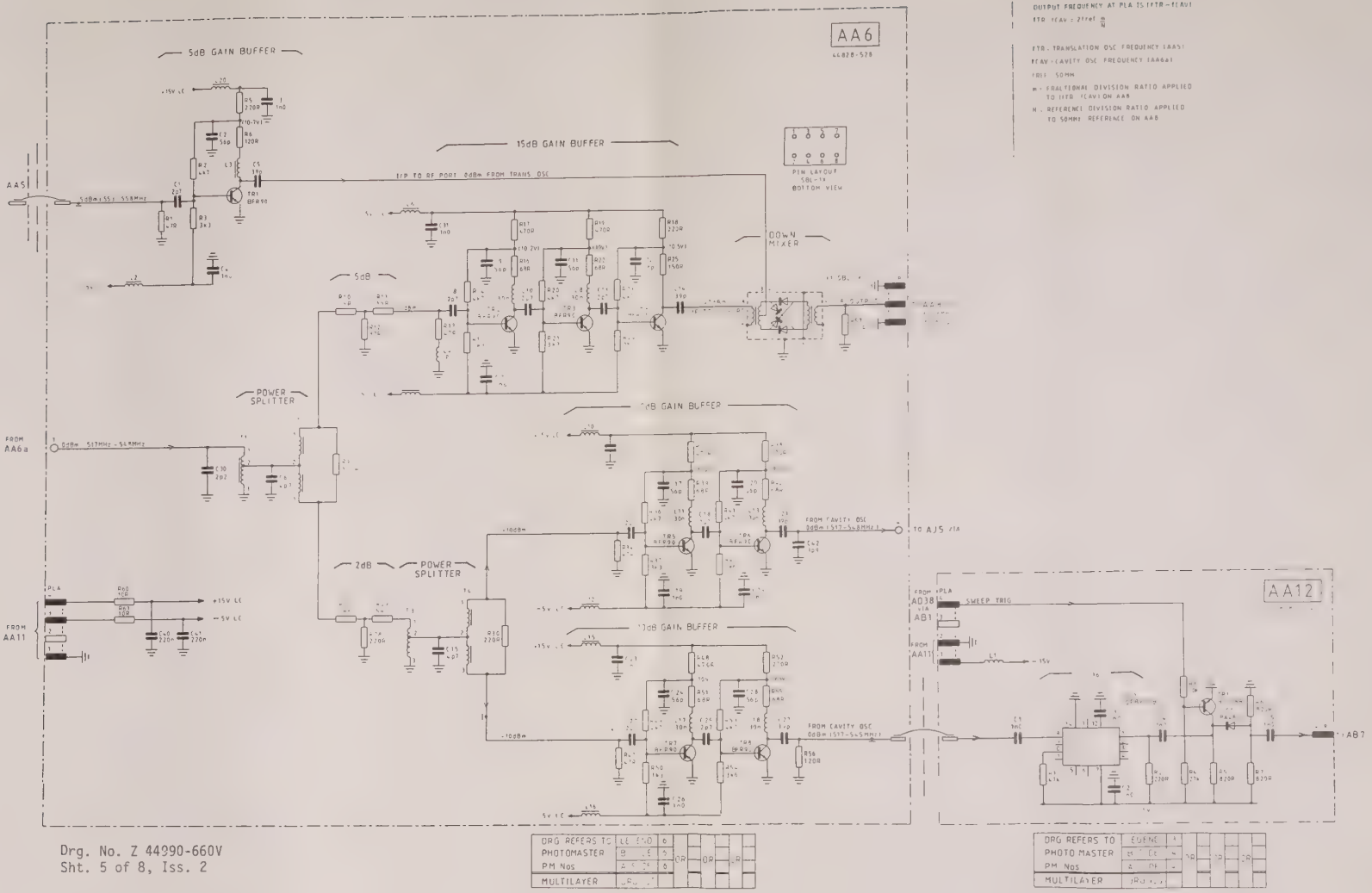
AD2 Log amplifier interface




Drg. No. Z 44829-140D
Sht. 2 of 4, Iss. ?

Fig. 35

AD2 Log amplifier interface

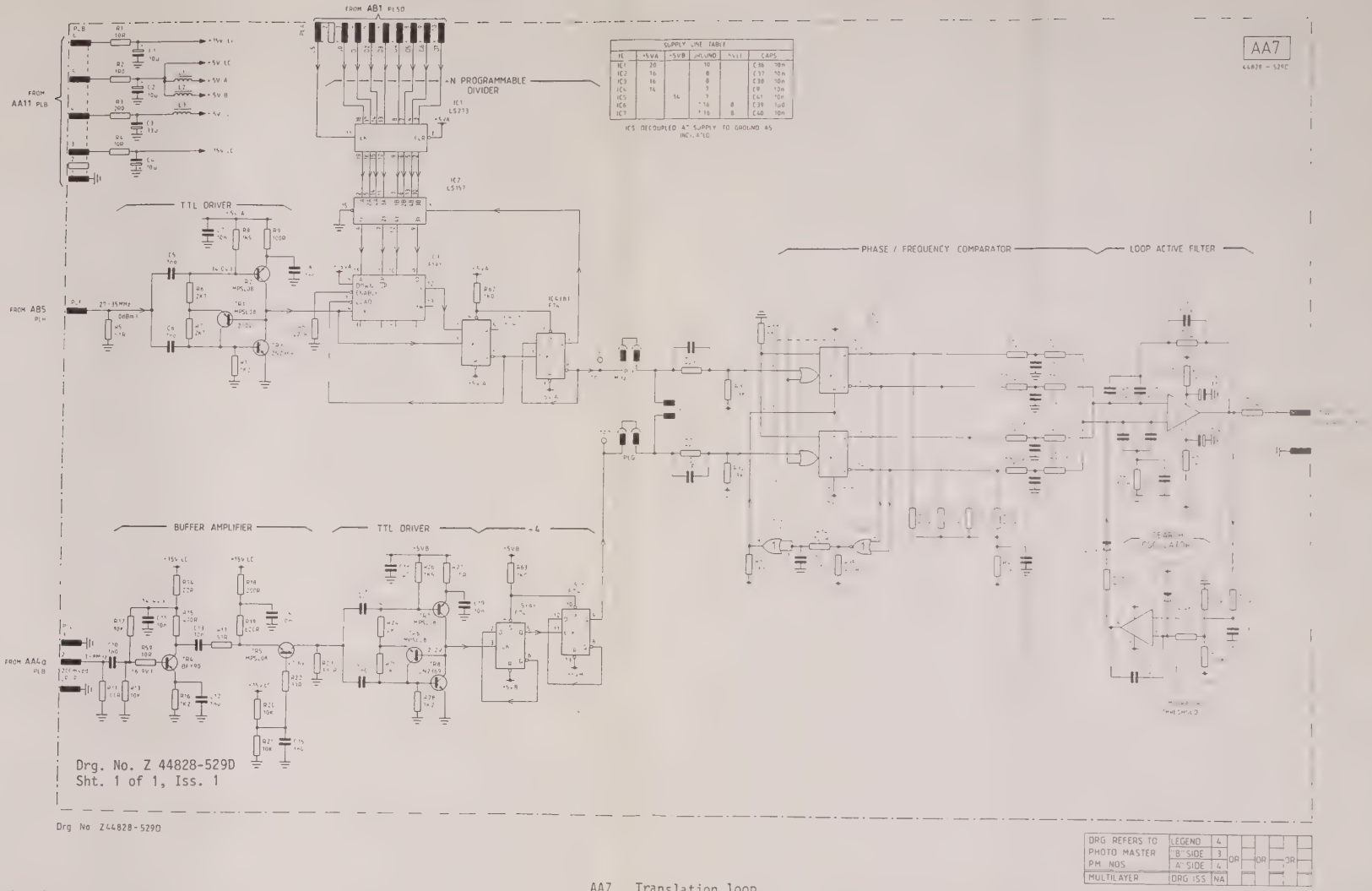



Drg. No. Z 44990-660V
Sht. 5 of 8, Iss. 2

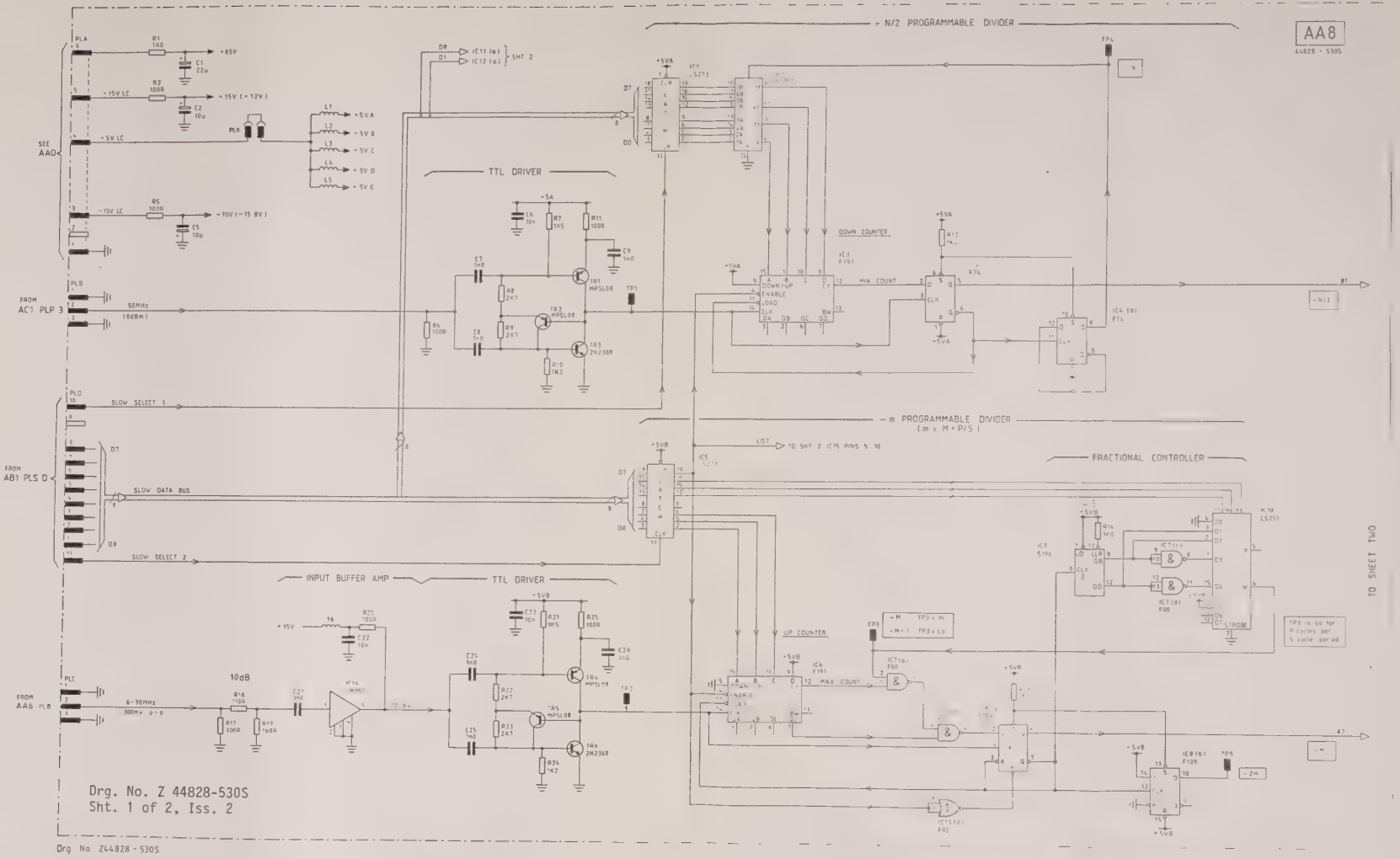
AA6 Cavity oscillator buffer
AA12 Divide by 16

Fig. 5

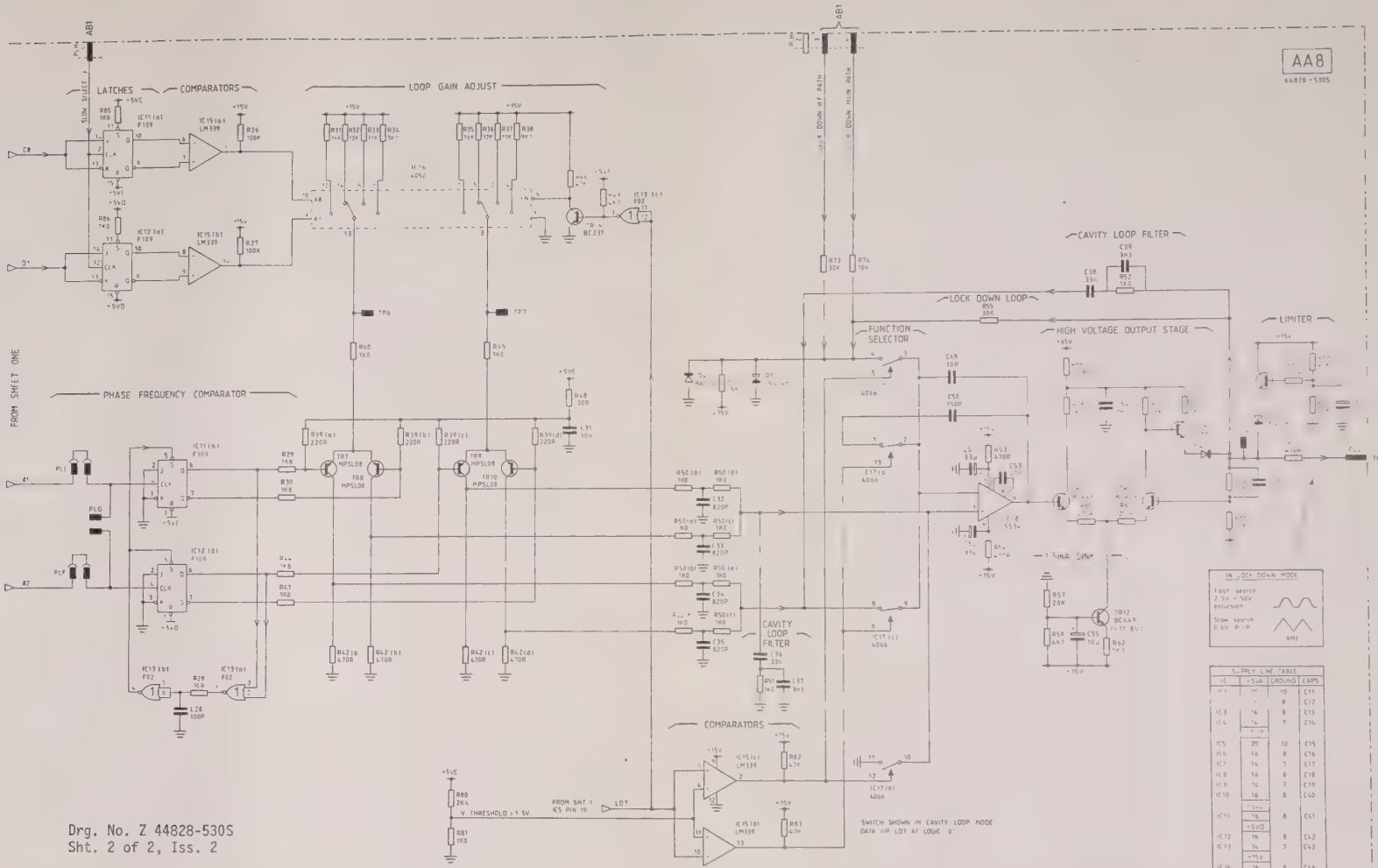
Sep. 87




| DRG REFERS TO | LEGEND | 4 | | | | |
|---|---|---|---|---|---|---|
| PHOTO MASTER | 'B' SIDE | 3 | OR | OR | OR | |
| PM NOS | 'A' SIDE | 4 | | | | |
| MULTILAYER | DRG ISS | NA | | | | |

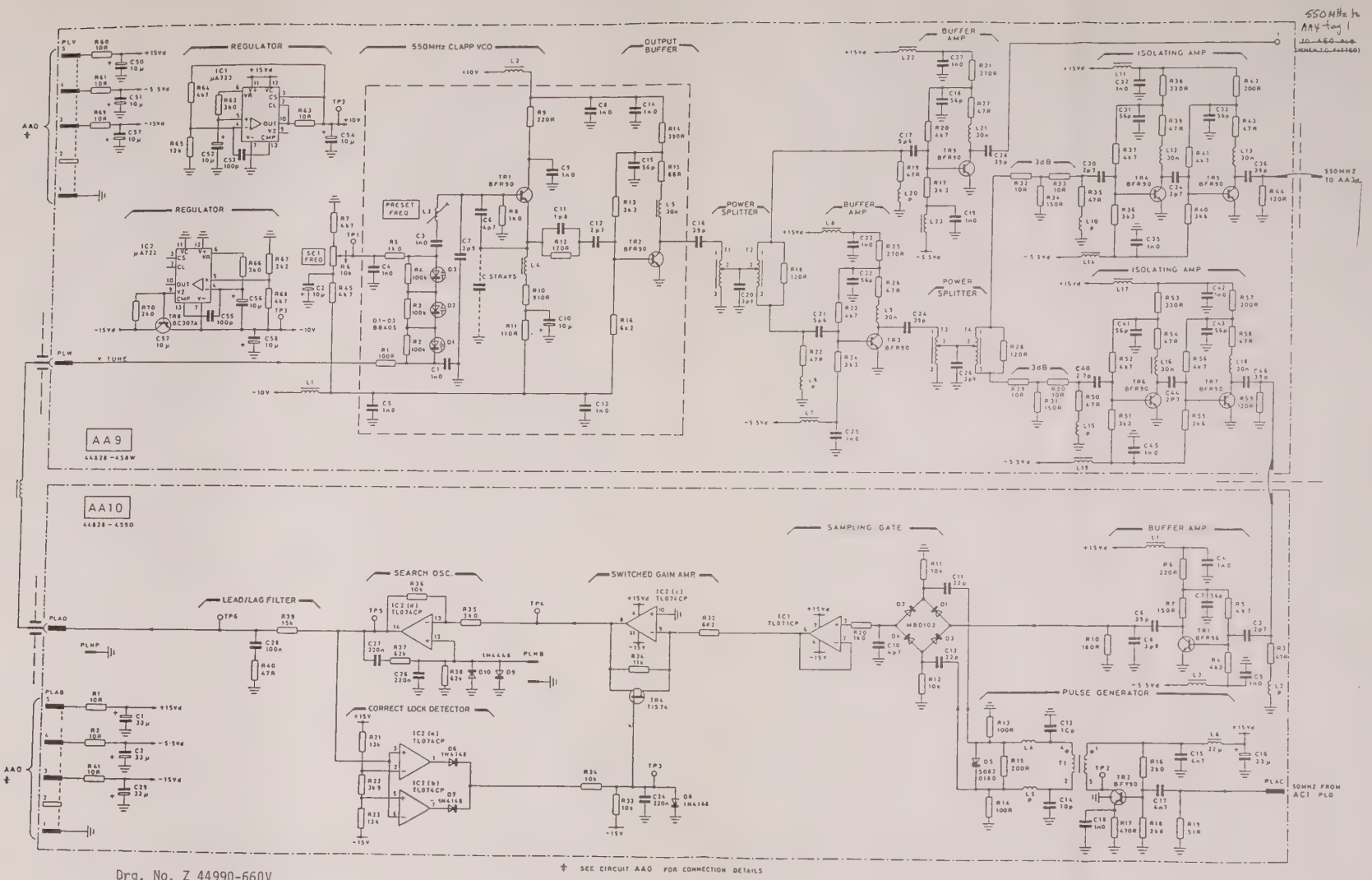



AA8 Fractional division p.l.l.




AA8 Franctional division p.l.l.

Fig. 8
Sep. 87




Drg. No. Z 44990-660V
Sht. 6 of 8, Iss. 1

‡ SEE CIRCUIT AAO FOR CONNECTION DETAILS

AA9/1 550 MHz v.c.o.
AA10/1 550 MHz phase detector

Fig. 9
Sep. 87

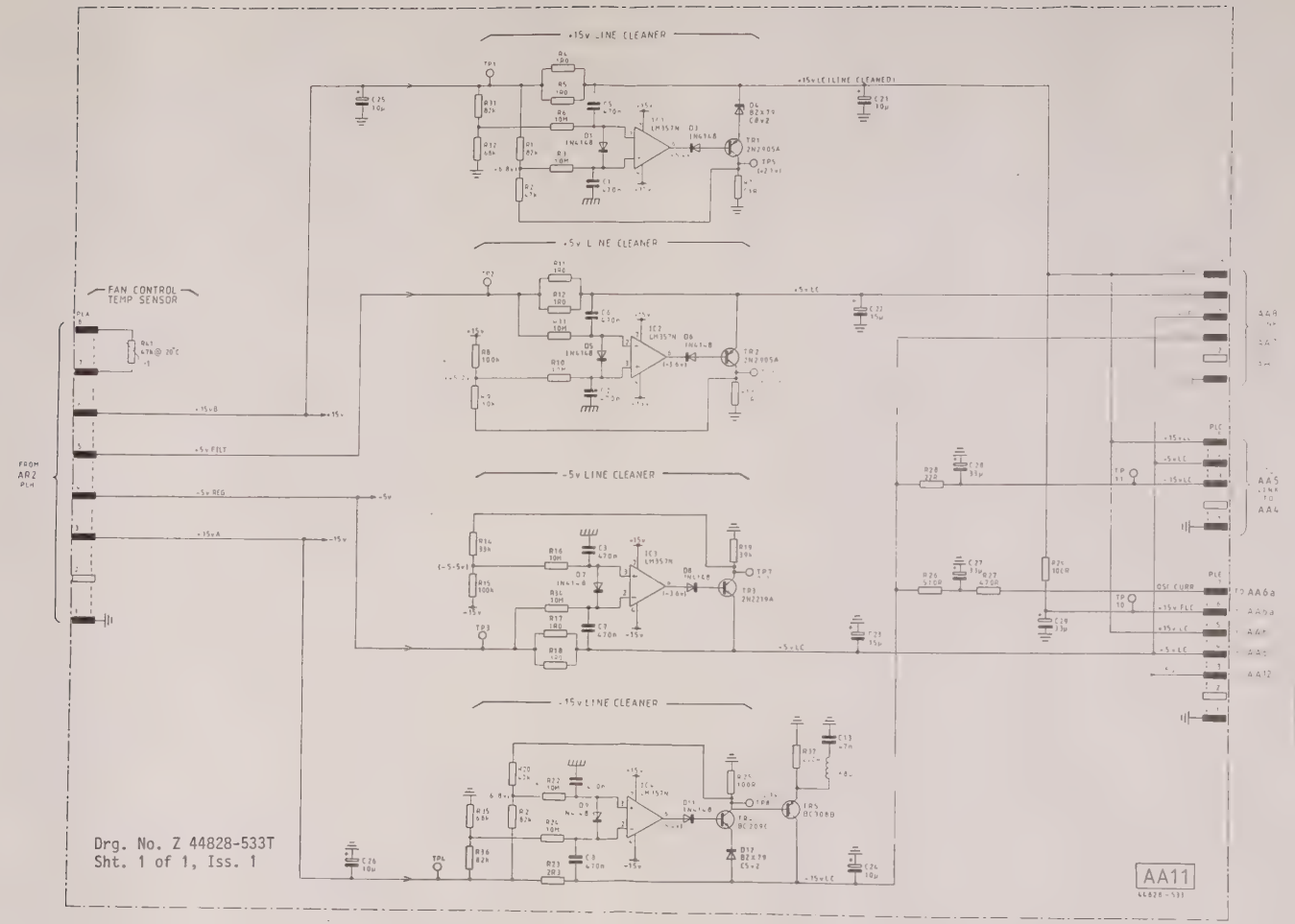


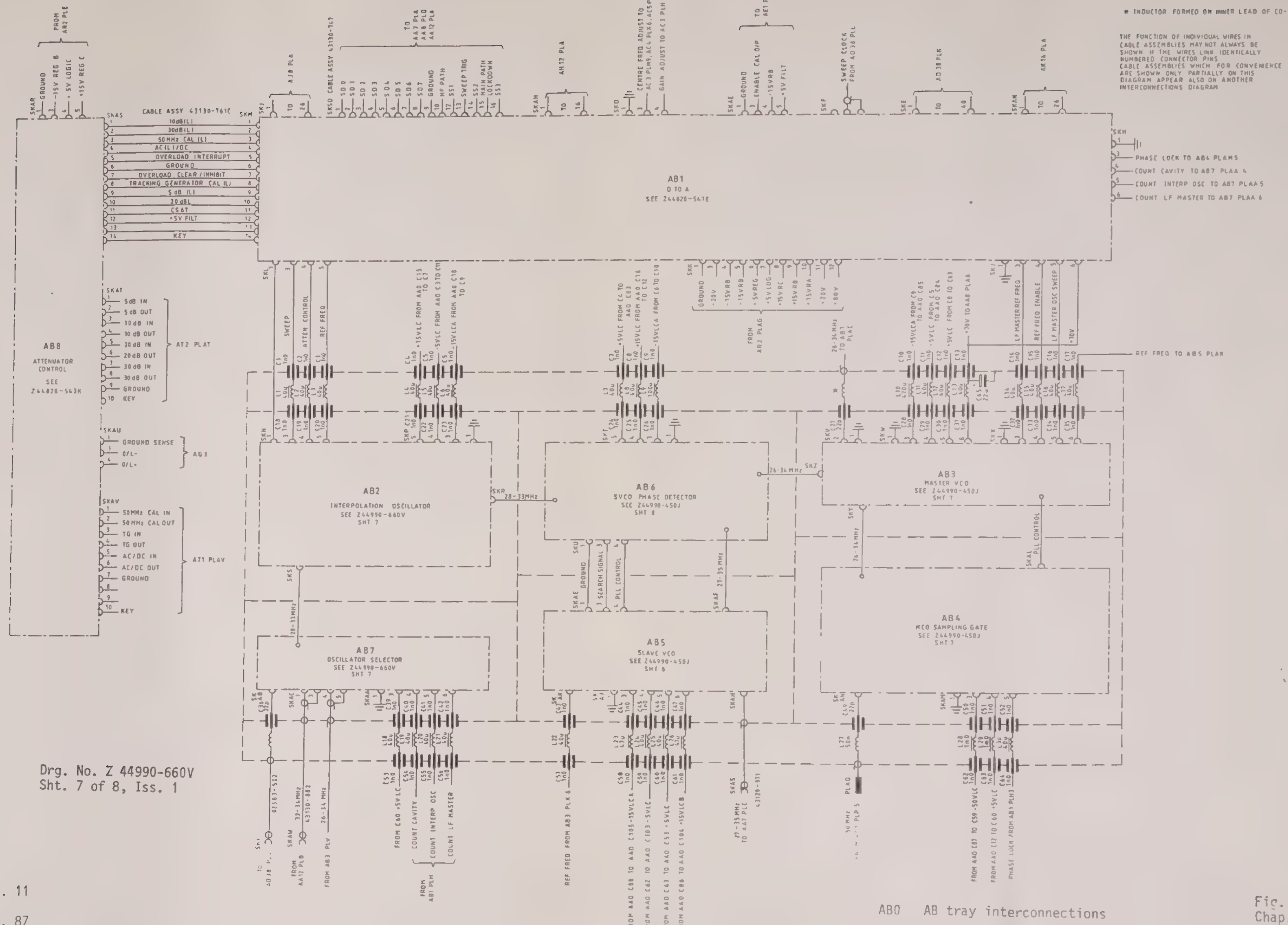

Fig. 10

AA11 Line cleaner

Sep. 87

* INDUCTOR FORMED ON INNER LEAD OF CO-AX

THE FUNCTION OF INDIVIDUAL WIRES IN CABLE ASSEMBLIES MAY NOT ALWAYS BE SHOWN IF THE WIRES LINK IDENTICALLY NUMBERED CONNECTOR PINS
CABLE ASSEMBLIES WHICH FOR CONVENIENCE ARE SHOWN ONLY PARTIALLY ON THIS DIAGRAM APPEAR ALSO ON ANOTHER INTERCONNECTIONS DIAGRAM

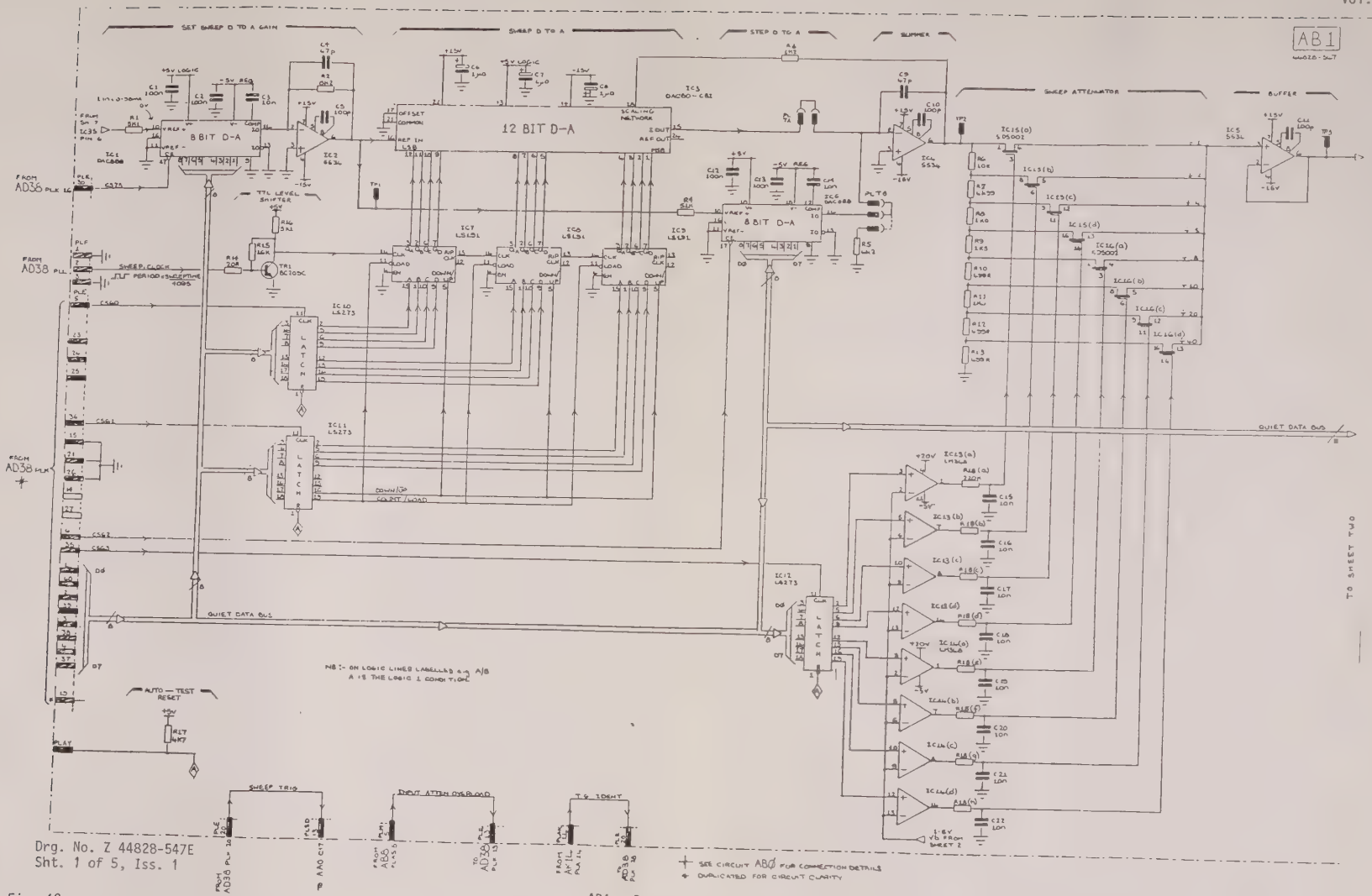



Drg. No. Z 44990-660V
Sht. 7 of 8, Iss. 1

Fig. 11

Sep. 87

AB0 AB tray interconnections

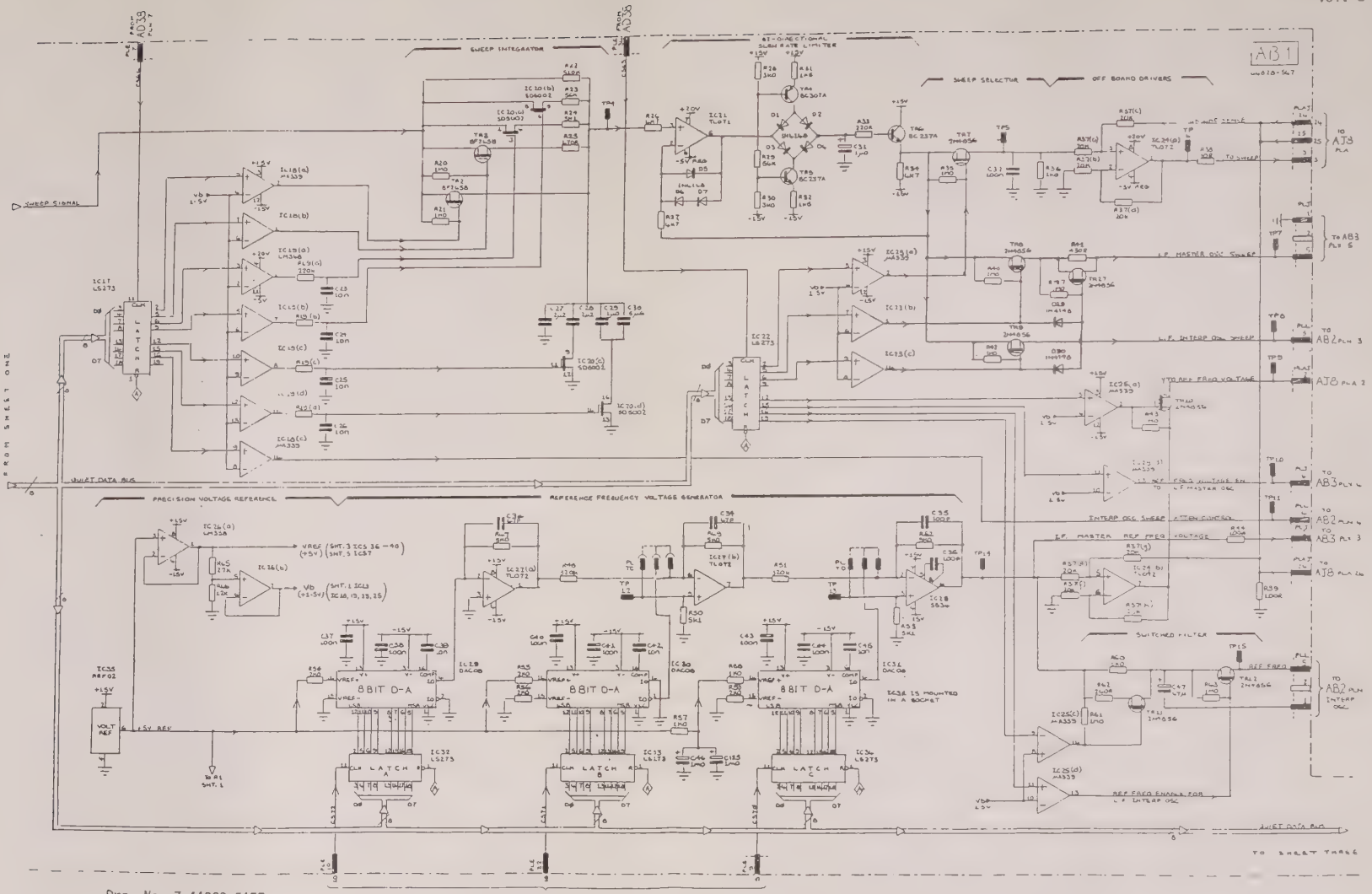



Drg. No. Z 44828-547E
Sht. 1 of 5, Iss. 1

Fig. 12

AB1 D to A converter

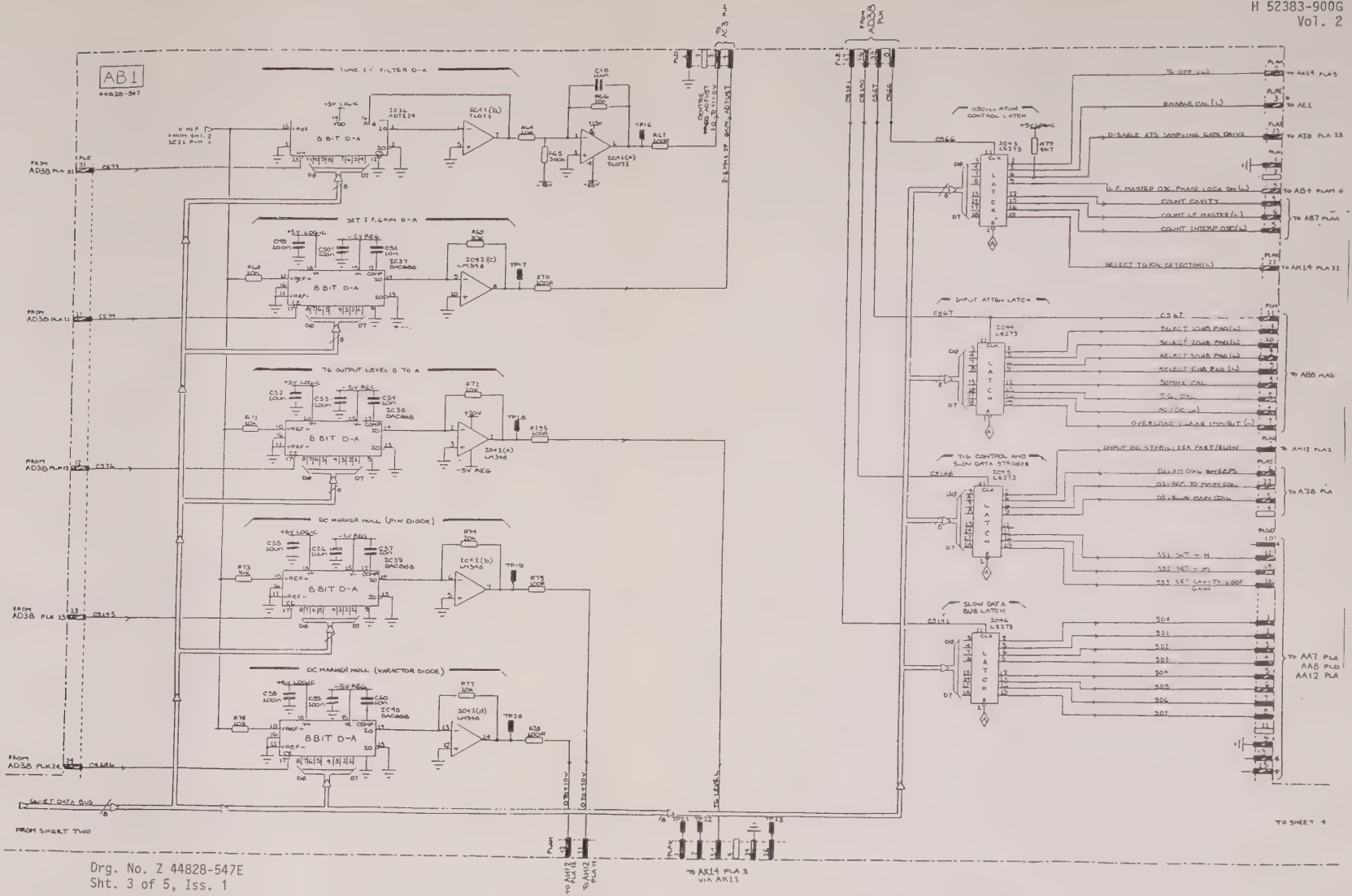
Sep. 87




Drg. No. Z 44828-547E
Sht. 2 of 5, Iss. 1

Fig. 13

Sep. 87

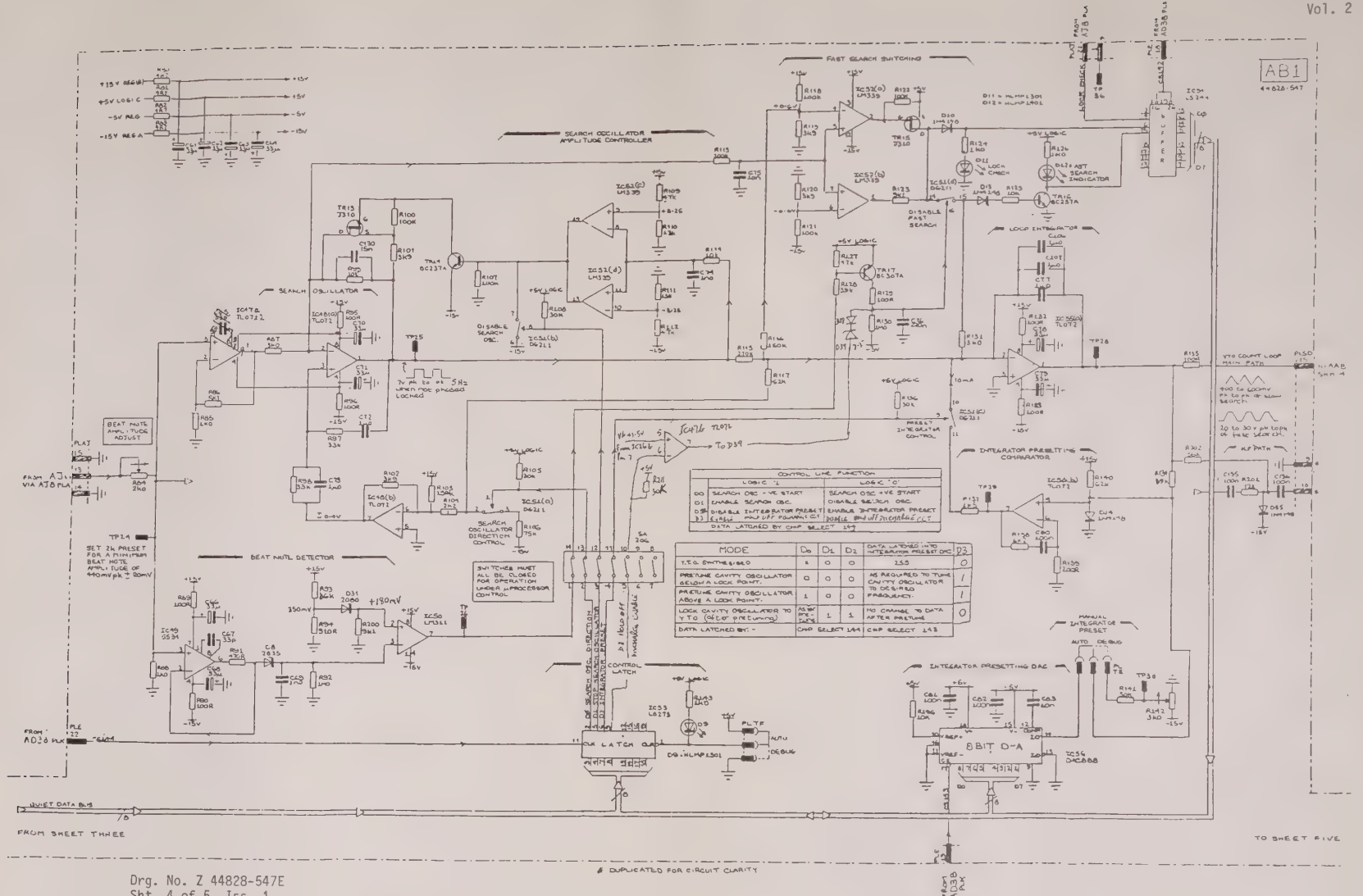



Drg. No. Z 44828-547E
Sht. 3 of 5, Iss. 1

Fig. 14

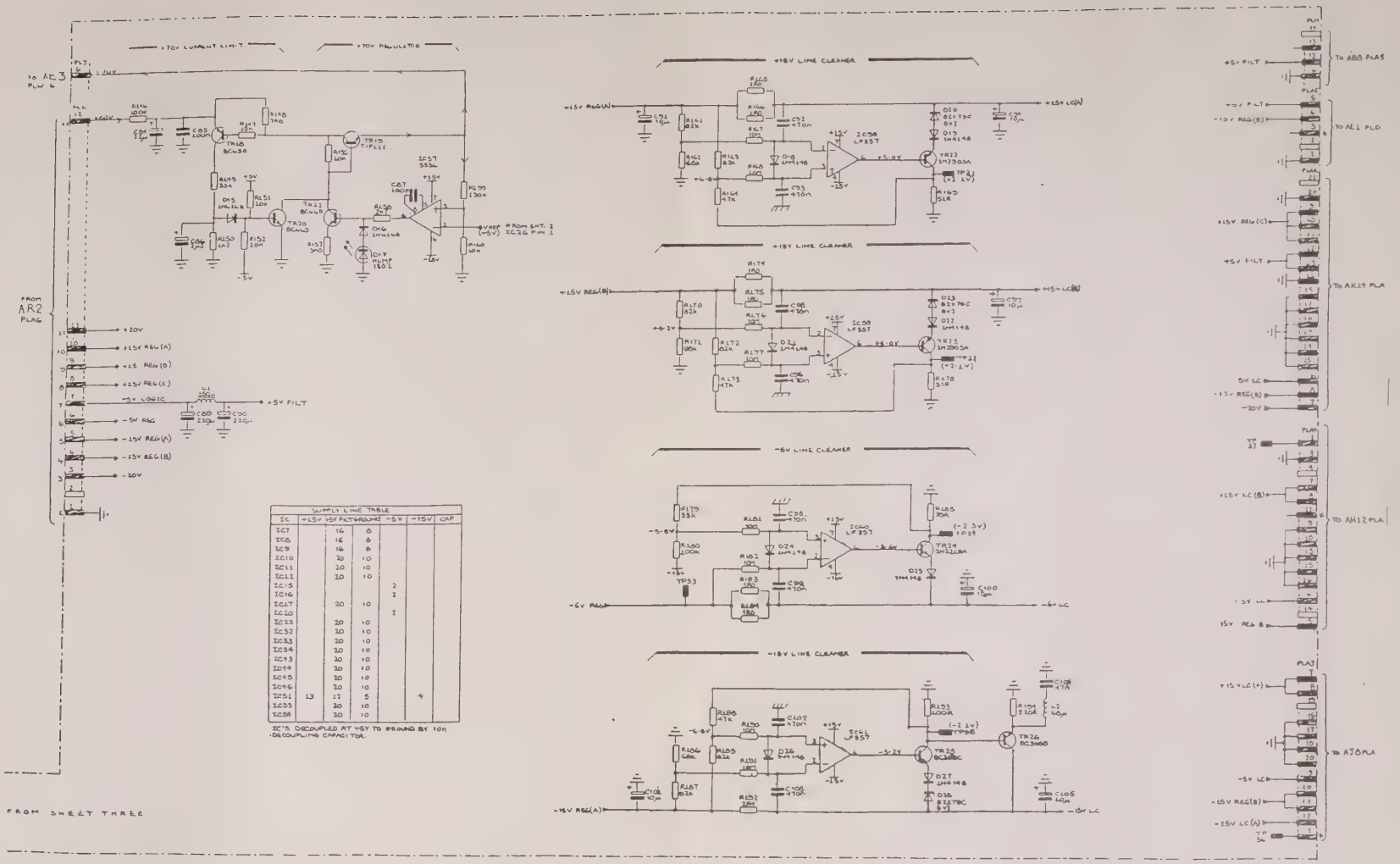
Sep. 87

AB1 D to A converter




Drg. No. Z 44828-547E
Sht. 4 of 5, Iss. 1

AB1 D to A converter

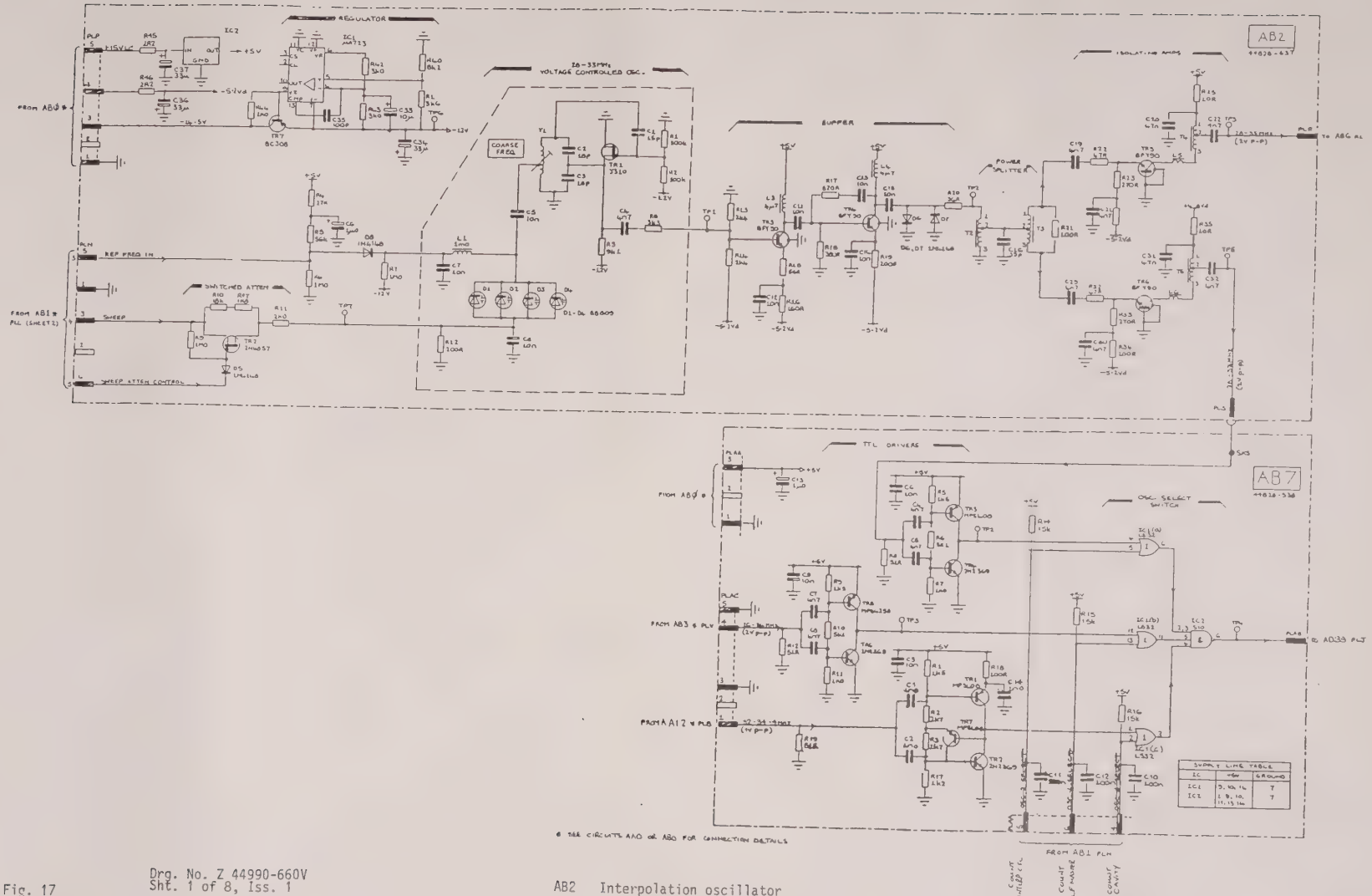



Drg. No. Z 44828-547E
Sht. 5 of 5, Iss. 1

Fig. 16

Sep. 87

AB1 D to A converter




Drg. No. Z 44990-660V
Sht. 1 of 8, Iss. 1

Fig. 17

Sep. 87

AB2 Interpolation oscillator
AB7 Oscillator select 27

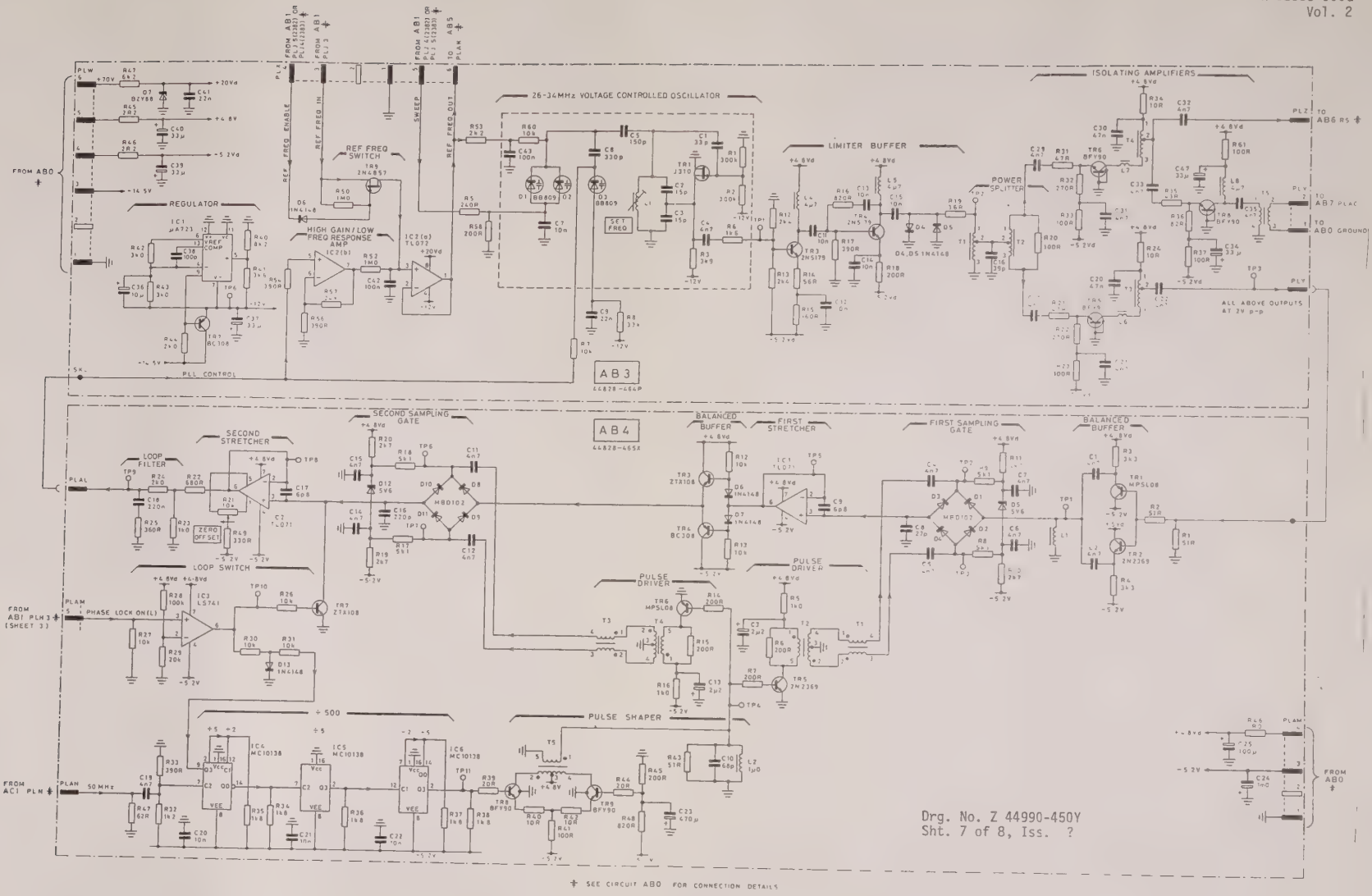



Fig. 18

Sep. 87

AB3 Master v.c.o.
AB4 Sampling gate

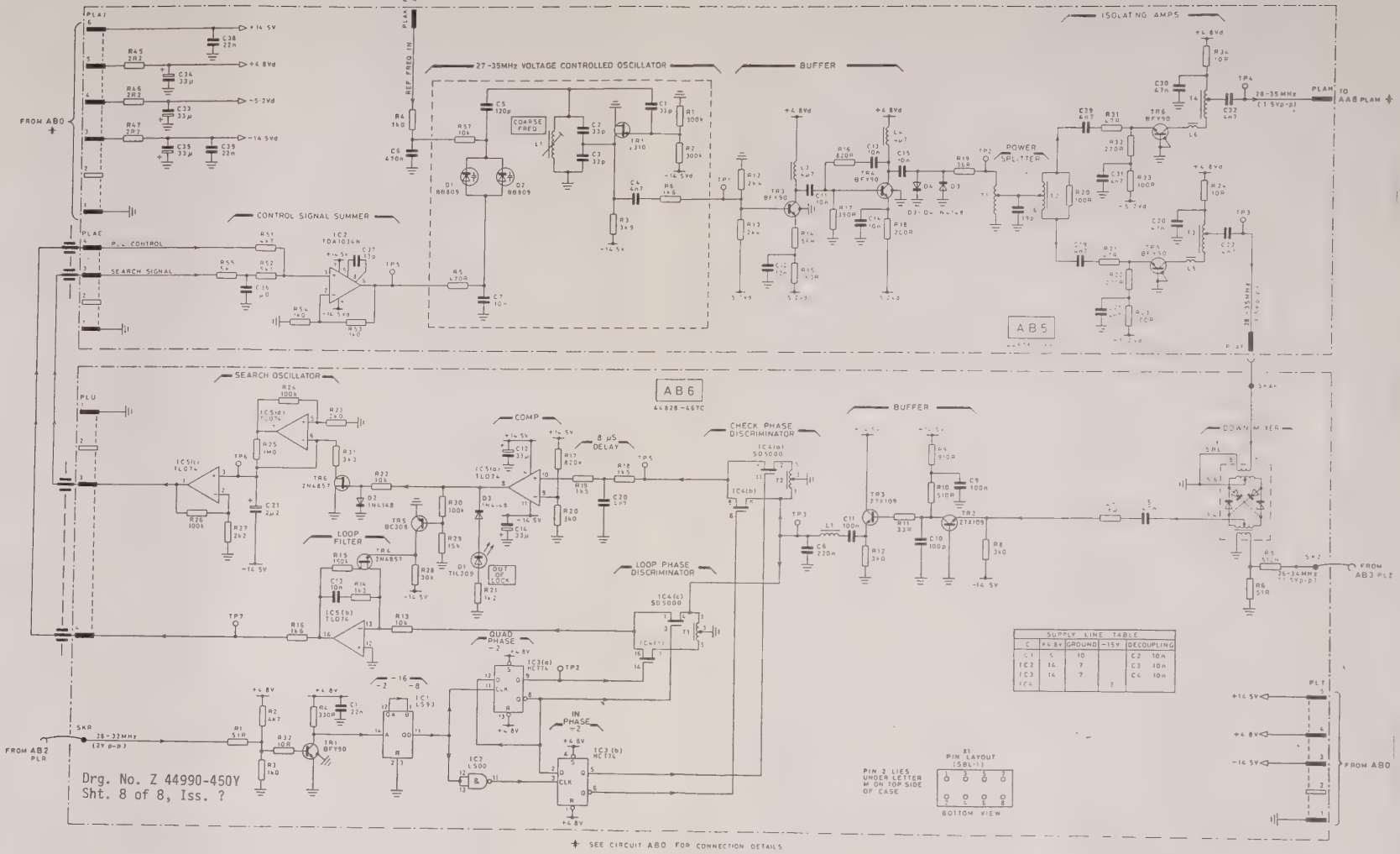
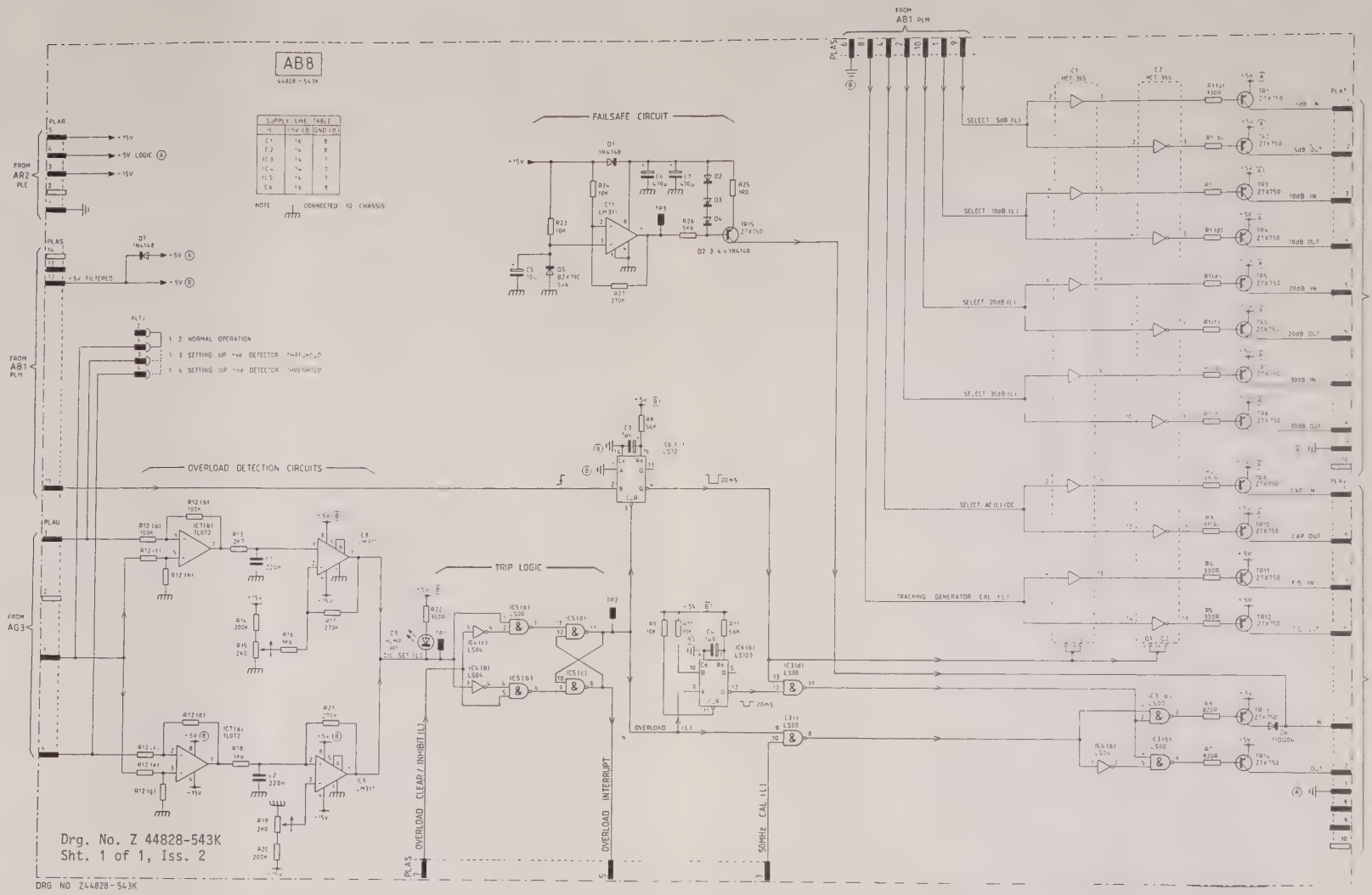


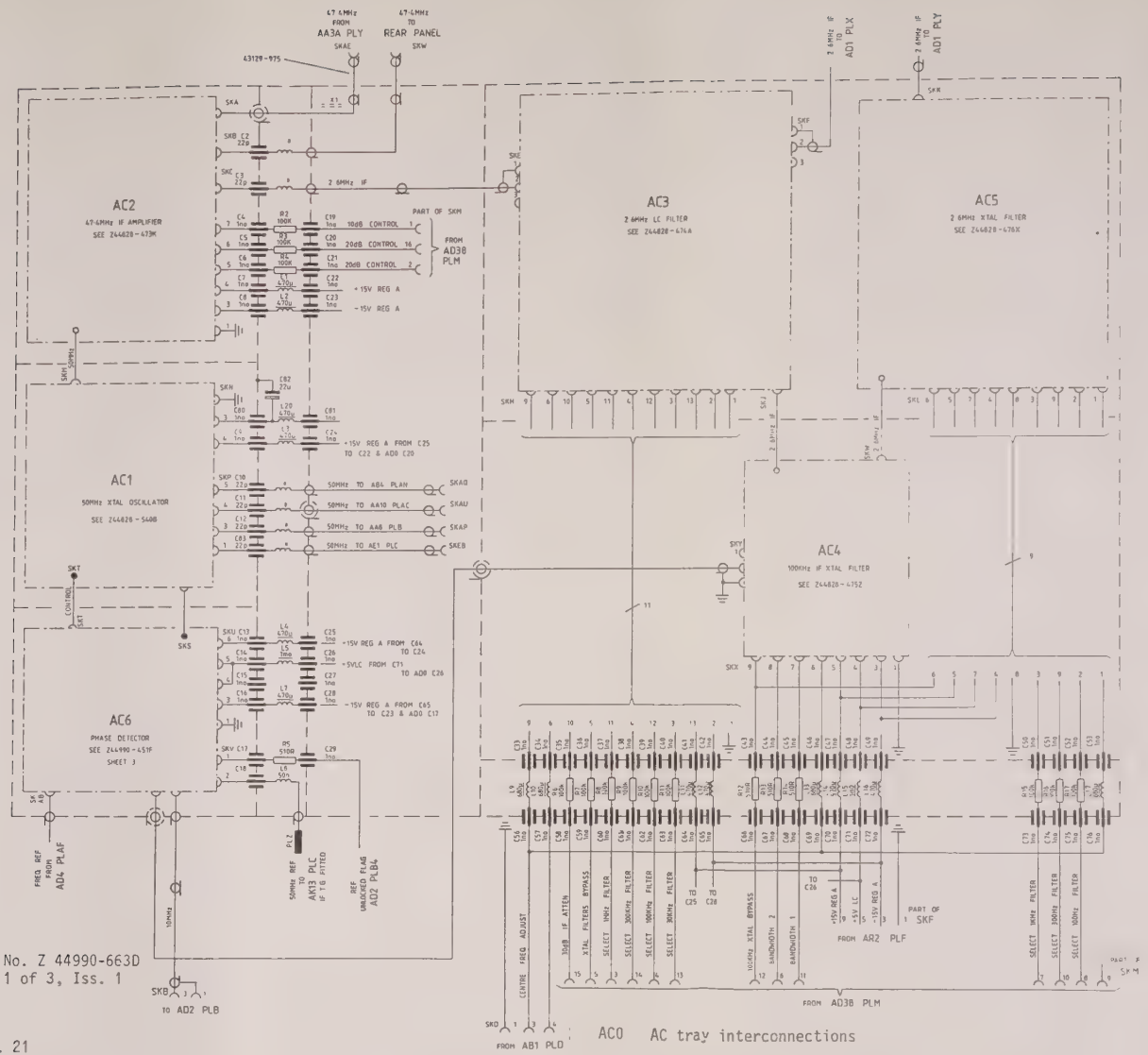

Fig. 19

Sep. 87

AB5 Slave v.c.o.
AB6 Phase detector




AB8 Attenuator control

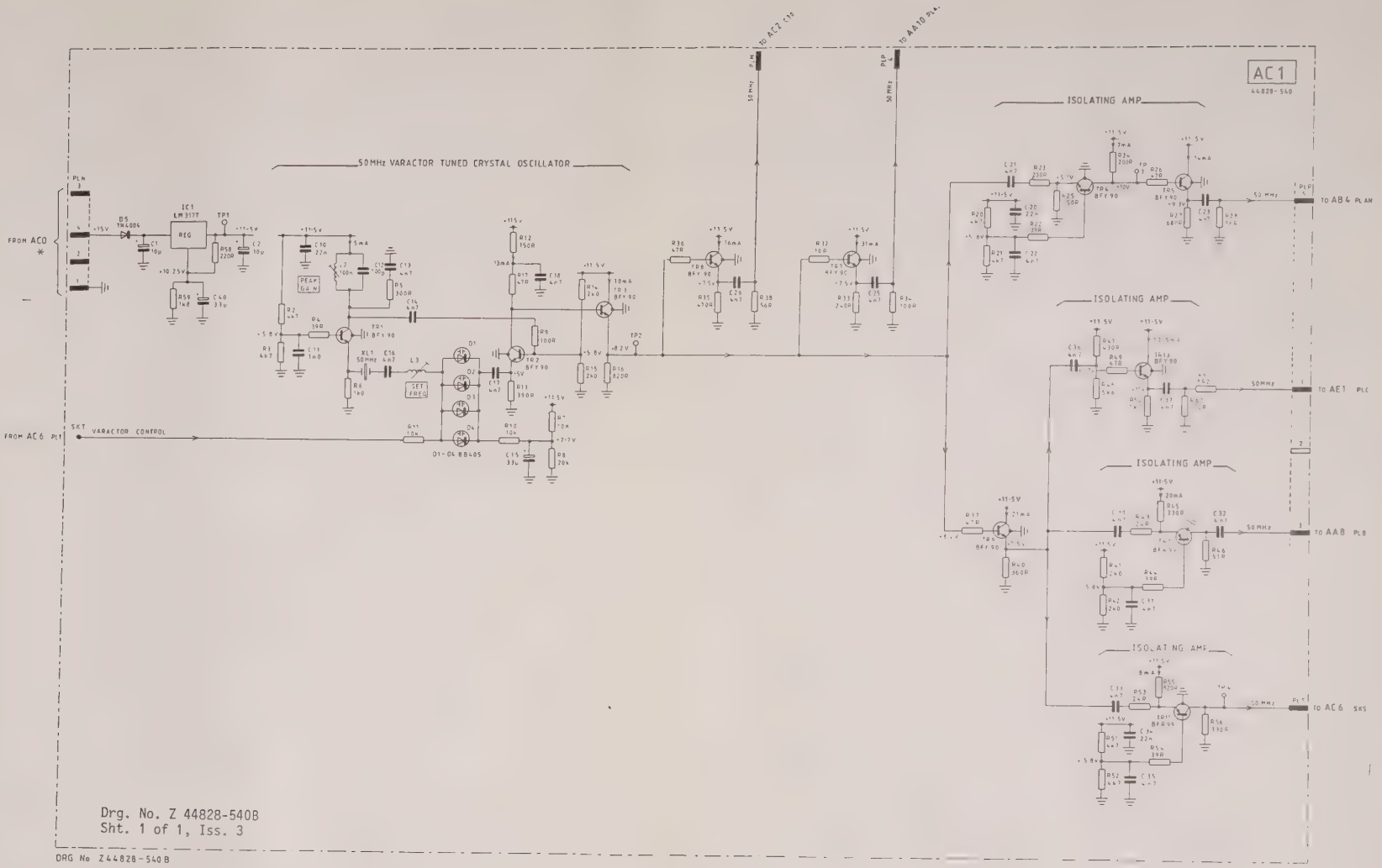



Drg. No. Z 44990-663D
Sht. 1 of 3, Iss. 1

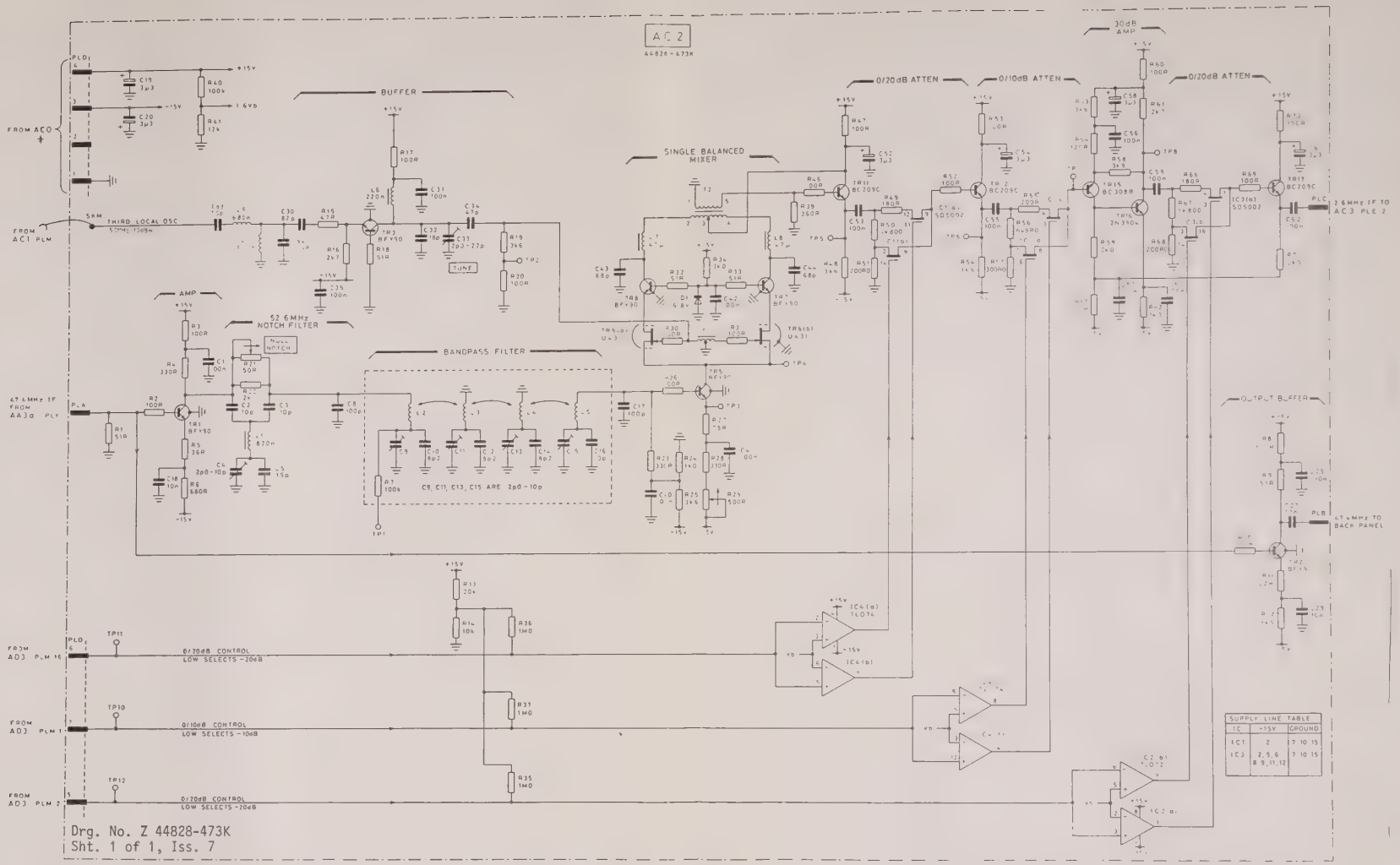
Fig. 21

AC0 AC tray interconnections

Sep. 87



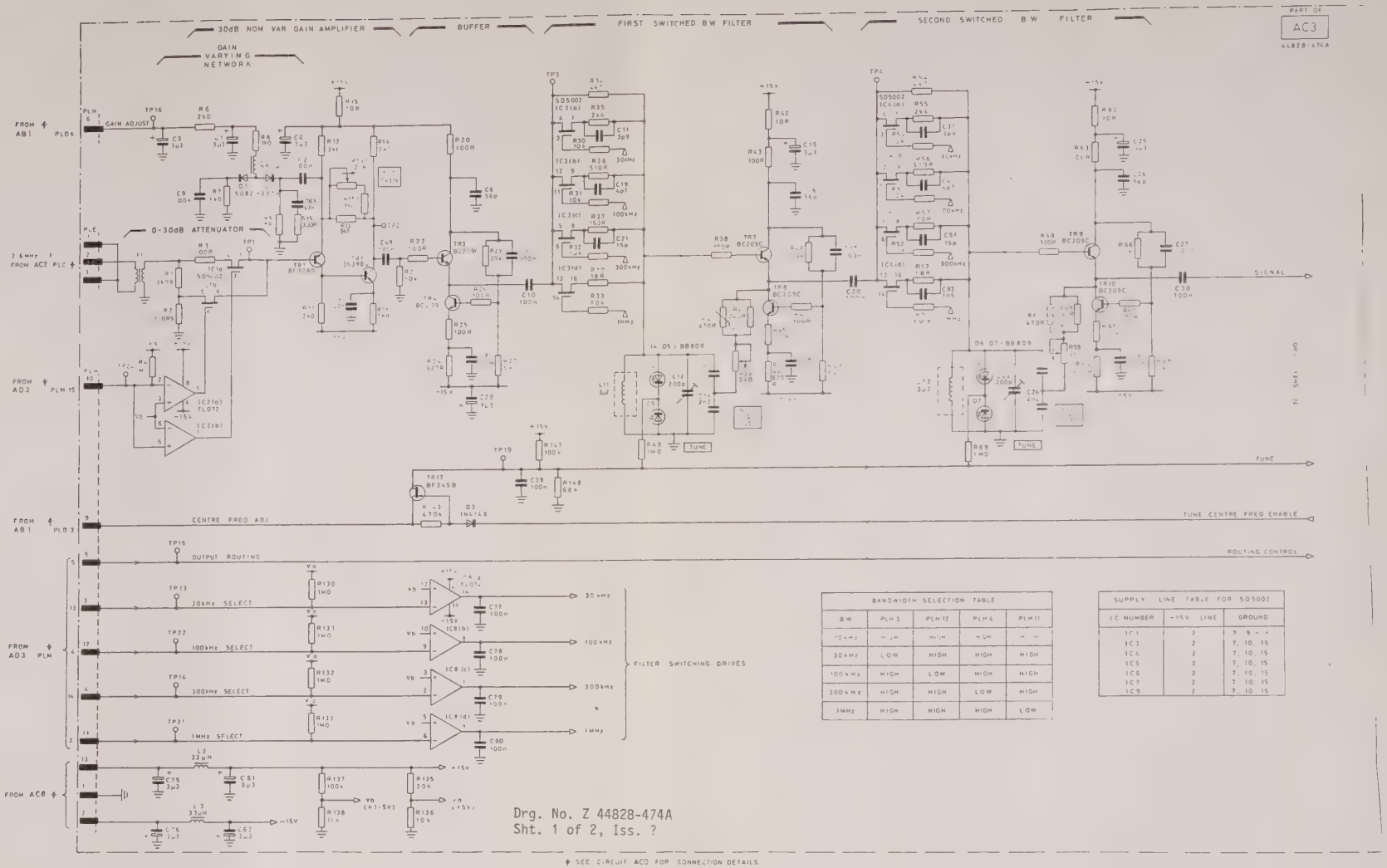

AC1 50 MHz crystal oscillator




Drg. No. Z 44828-473K
Sht. 1 of 1, Iss. 7

✦ SEE CIRCUIT AC0 FOR CONNECTION DETAILS

AC2 47.4 MHz i.f. amplifier

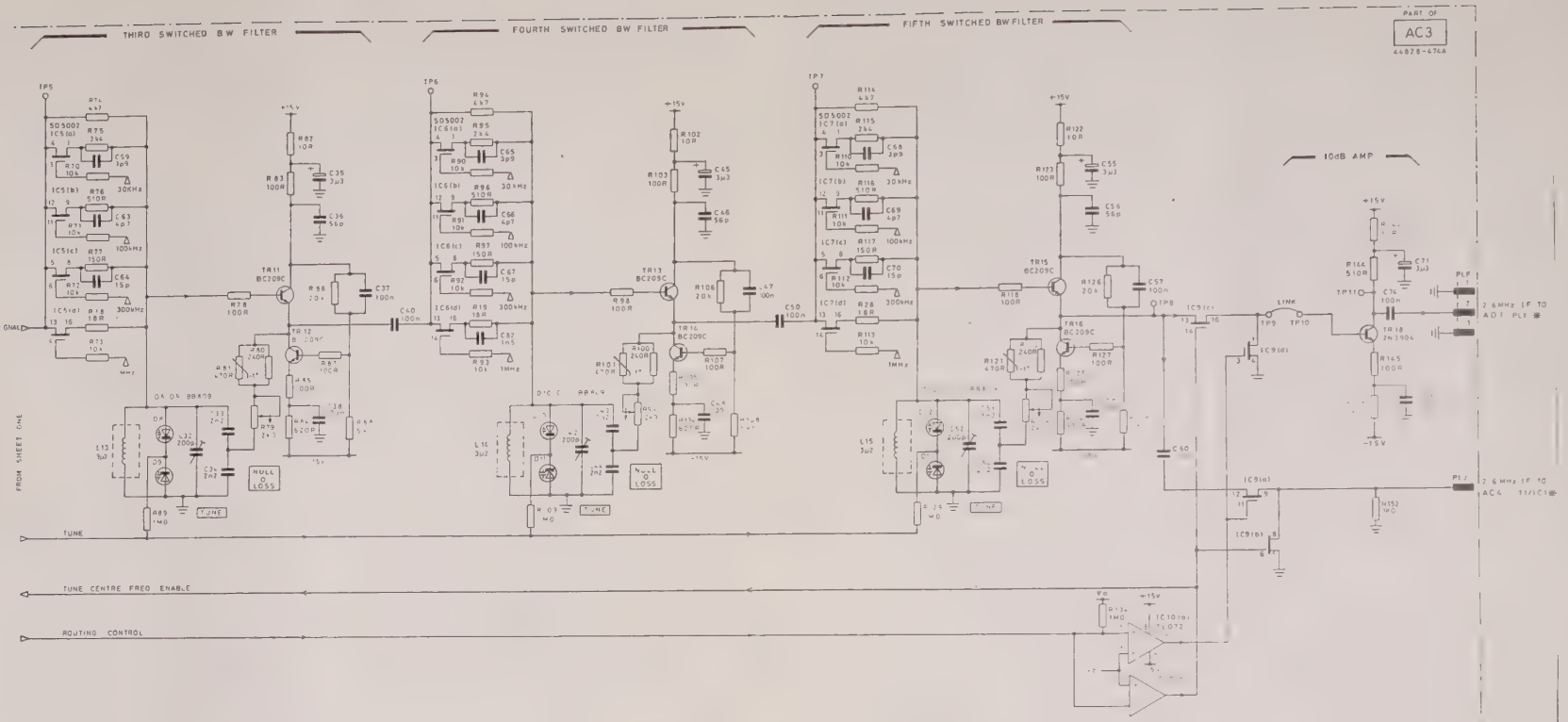



| BANDWIDTH SELECTION TABLE | | | | |
|---|---|---|---|---|
| BW | PLM 3 | PLM 12 | PLM 4 | PLM 11 |
| 10kHz | HIGH | HIGH | HIGH | HIGH |
| 30kHz | LOW | HIGH | HIGH | HIGH |
| 100kHz | HIGH | LOW | HIGH | HIGH |
| 300kHz | HIGH | HIGH | LOW | HIGH |
| 1MHz | HIGH | HIGH | HIGH | LOW |

| SUPPLY LINE TABLE FOR SD5002 | | |
|---|---|---|
| IC NUMBER | -15V LINE | GROUND |
| IC1 | 2 | 9 |
| IC3 | 2 | 7, 10, 15 |
| IC4 | 2 | 7, 10, 15 |
| IC5 | 2 | 7, 10, 15 |
| IC6 | 2 | 7, 10, 15 |
| IC7 | 2 | 7, 10, 15 |
| IC9 | 2 | 7, 10, 15 |

Drg. No. Z 44828-474A
Sht. 1 of 2, Iss. ?

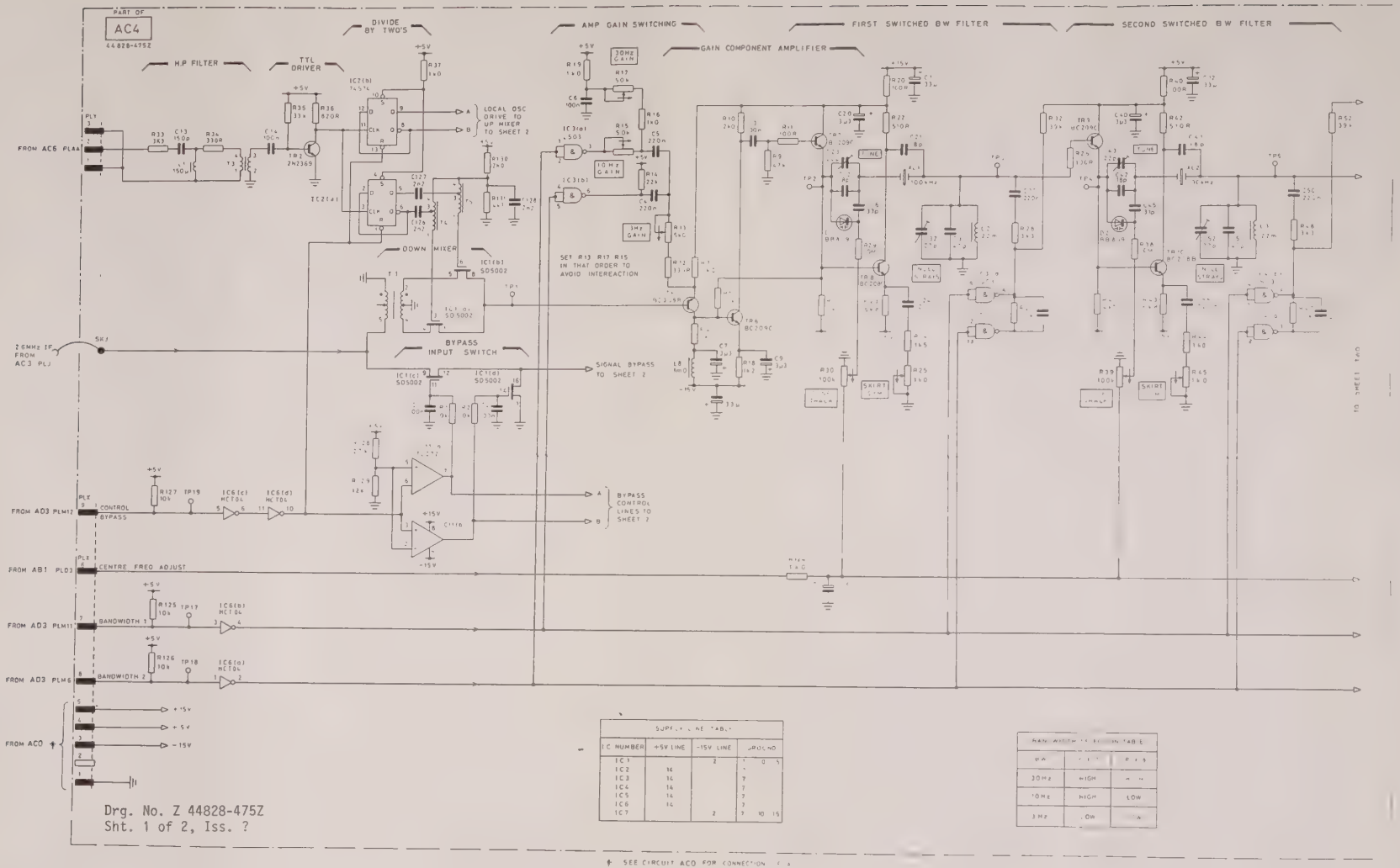
AC3 2.6 MHz LC filter



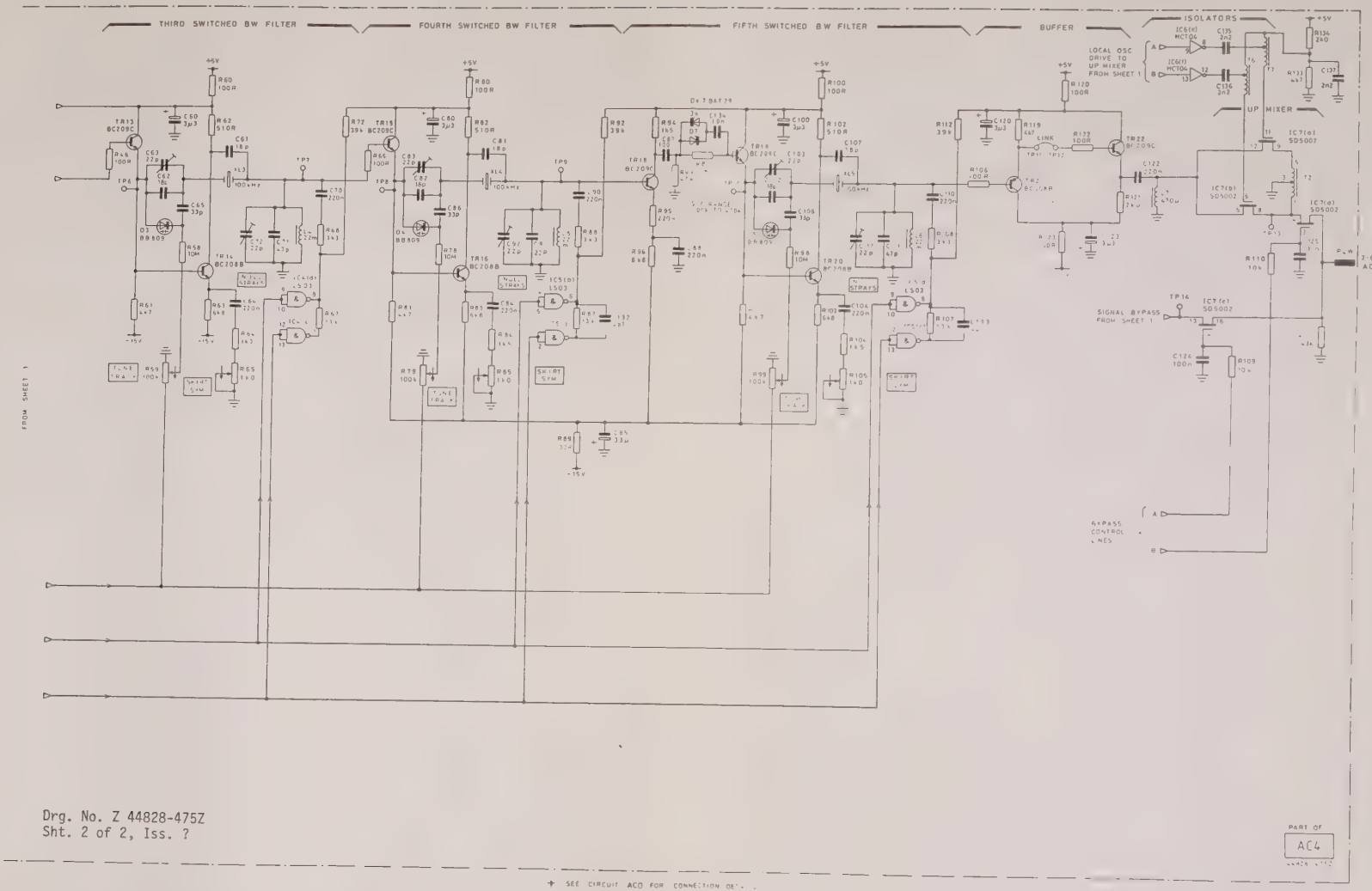

Drg. No. Z 44828-474A
Sht. 2 of 2, Iss. ?

* SEE CIRCUIT AC0 FOR CONNECTION DETAILS

AC3 2.6 MHz LC filter




AC4 100 kHz i.f. crystal filter



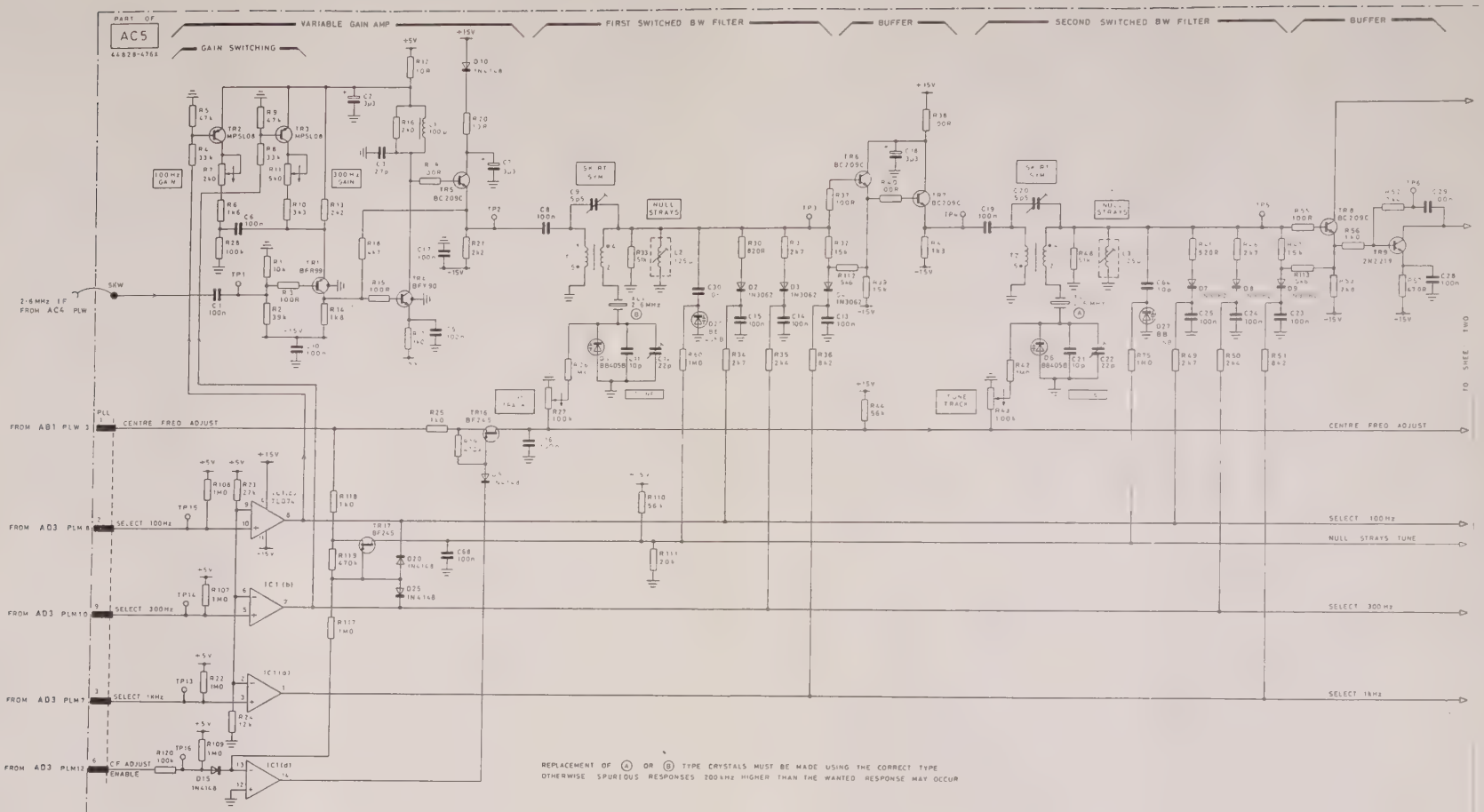

Drg. No. Z 44828-475Z
Sht. 2 of 2, Iss. ?

* SEE CIRCUIT AC0 FOR CONNECTION DETS.

Fig. 27

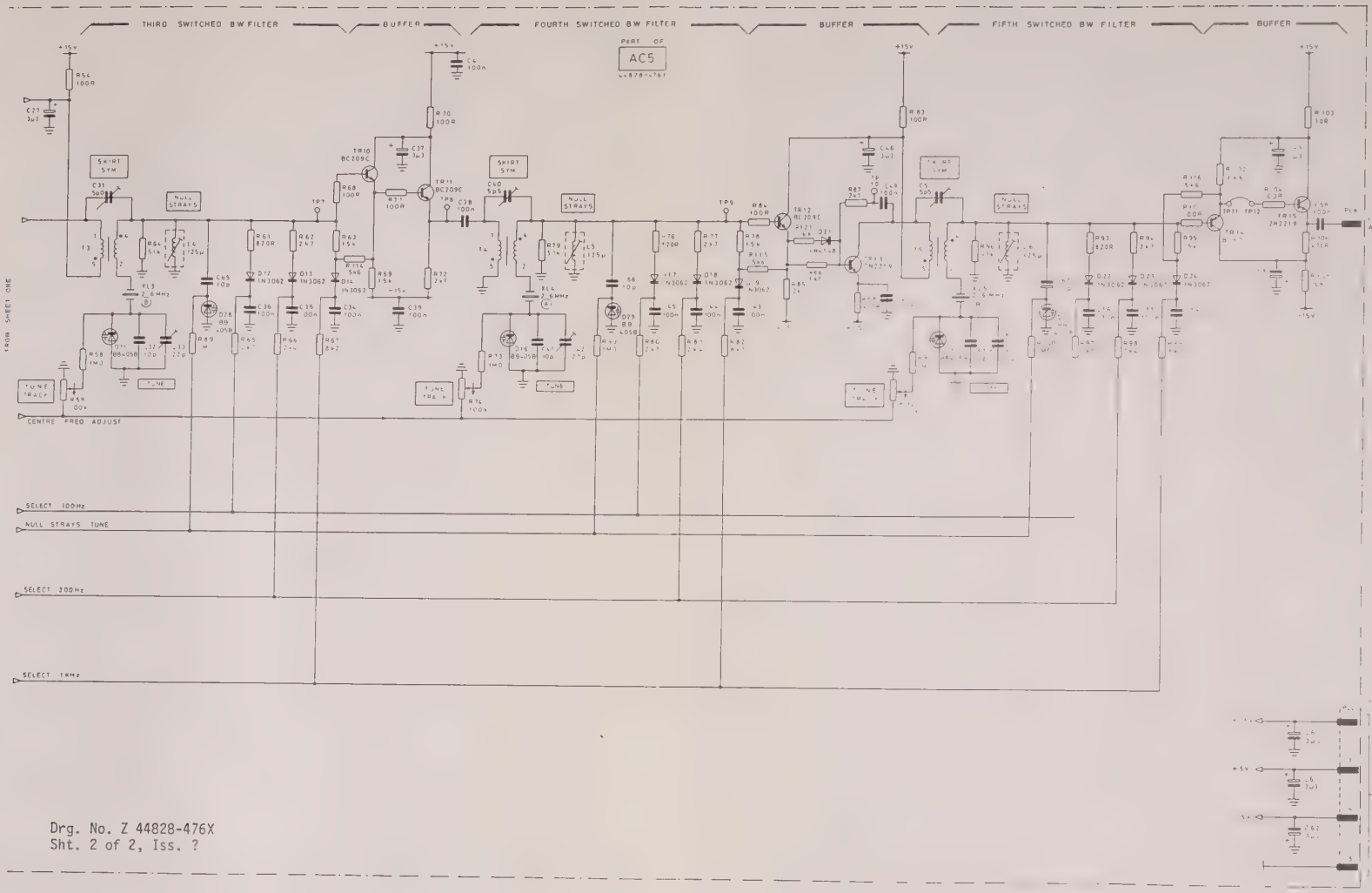
Sep. 87

AC4 100 kHz i.f. crystal filter




* SEE CIRCUIT AC0 FOR CONNECTION DETAILS

AC5 2.6 MHz crystal filter

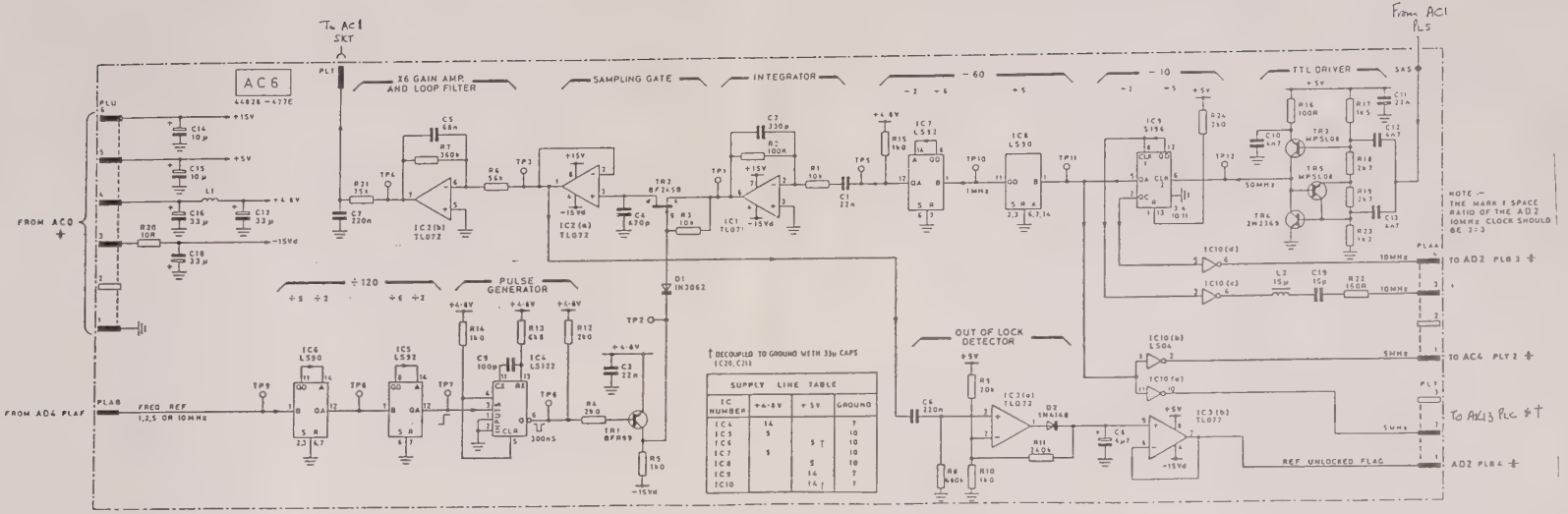


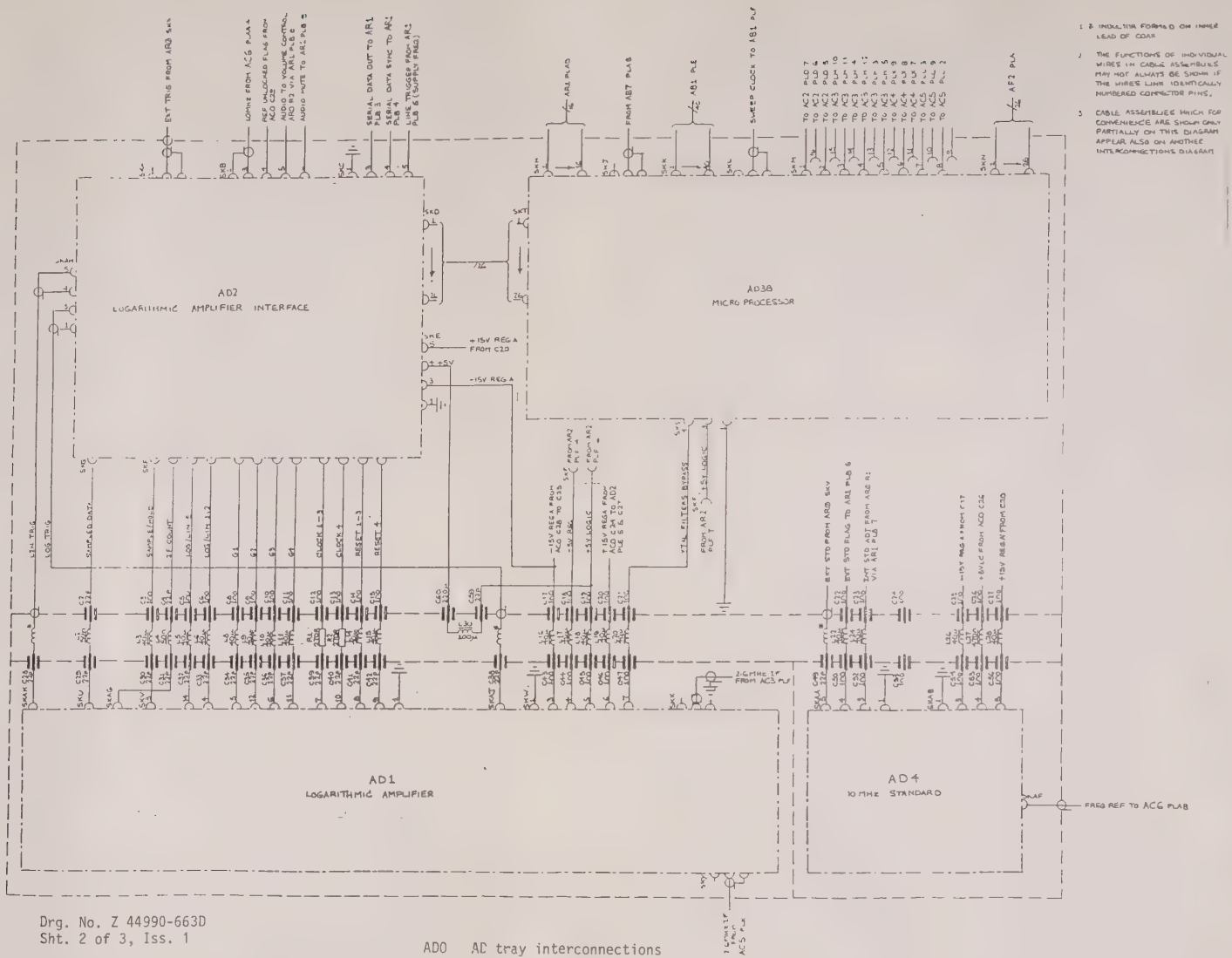

Drg. No. Z 44828-476X
Sht. 2 of 2, Iss. ?

Fig. 29

AC5 2.6 MHz crystal filter

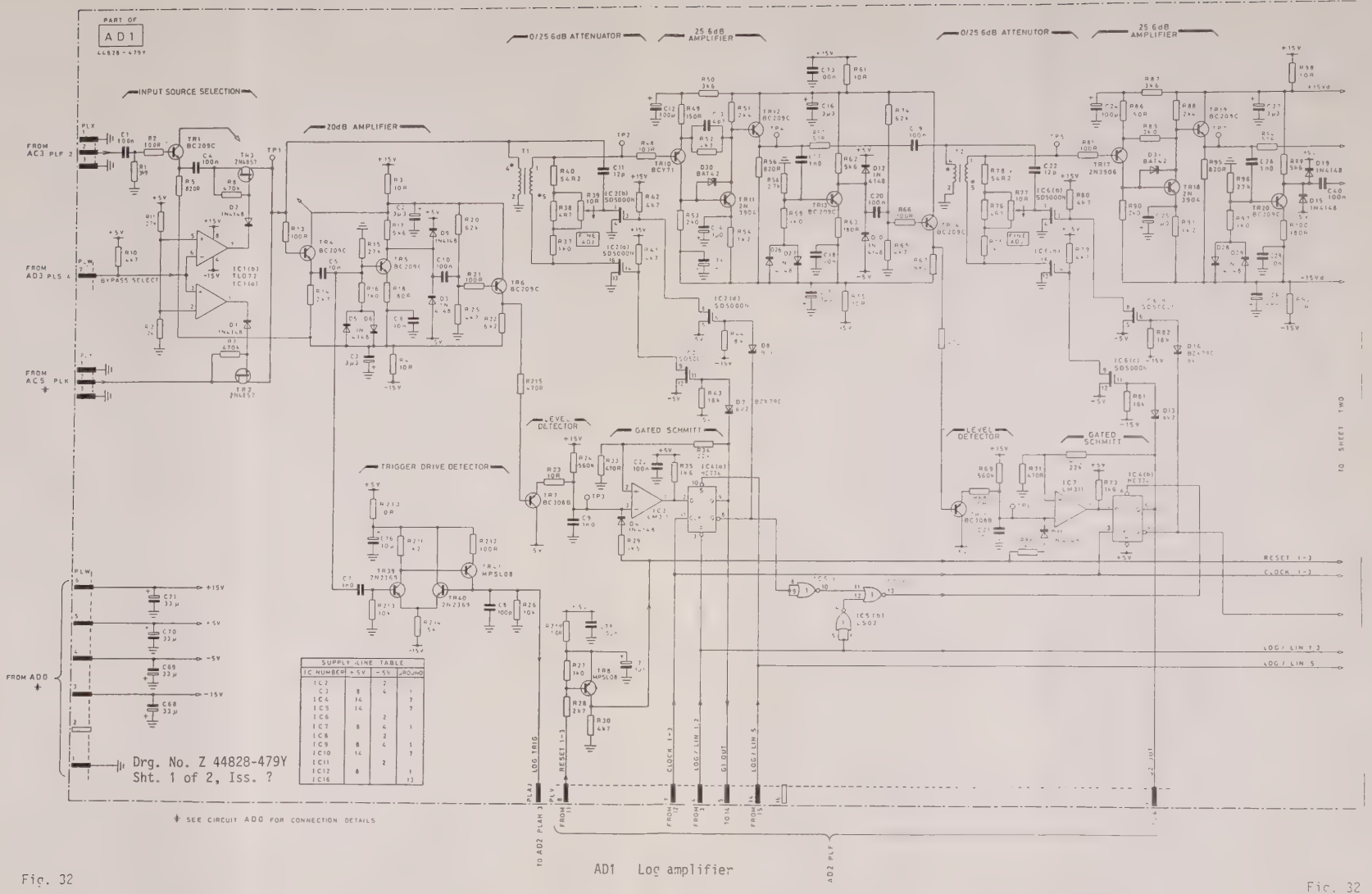
Sep. 87


AC6
44828-477E
To AC1 SKT
From AC1 PL5
X6 GAIN AMP AND LOOP FILTER
SAMPLING GATE
INTEGRATOR
÷60
÷10
TTL DRIVER
÷120
PULSE GENERATOR
OUT OF LOCK DETECTOR
FROM AC0
FROM AD4 PLAF
FREQ REF 1,2,5 OR 10MHz
TO AD2 PLB 3
TO AC4 PLT 2
TO AK13 PLC
AD2 PLB 4
REF UNLOCKED FLAG
NOTE — THE MARK : SPACE RATIO OF THE AD2 10MHz CLOCK SHOULD BE 2:3
SUPPLY LINE TABLE
IC NUMBER | +4.8V | +5V | GROUND
IC4 | 14 | | 7
IC5 | 5 | | 10
IC6 | | 5 | 10
IC7 | 5 | | 10
IC8 | | 5 | 10
IC9 | | 16 | 7
IC10 | | 14 | 7
† DECOUPLED TO GROUND WITH 33μ CAPS (IC20, C21)
Drg. No. Z 44828-477E
Sht. 1 of 1, Iss. 1
* SEE CIRCUIT AC0 FOR CONNECTION DETAILS
† IF TRACKING GENERATOR FITTED




Drg. No. Z 44990-663D
Sht. 2 of 3, Iss. 1

AD0 AC tray interconnections

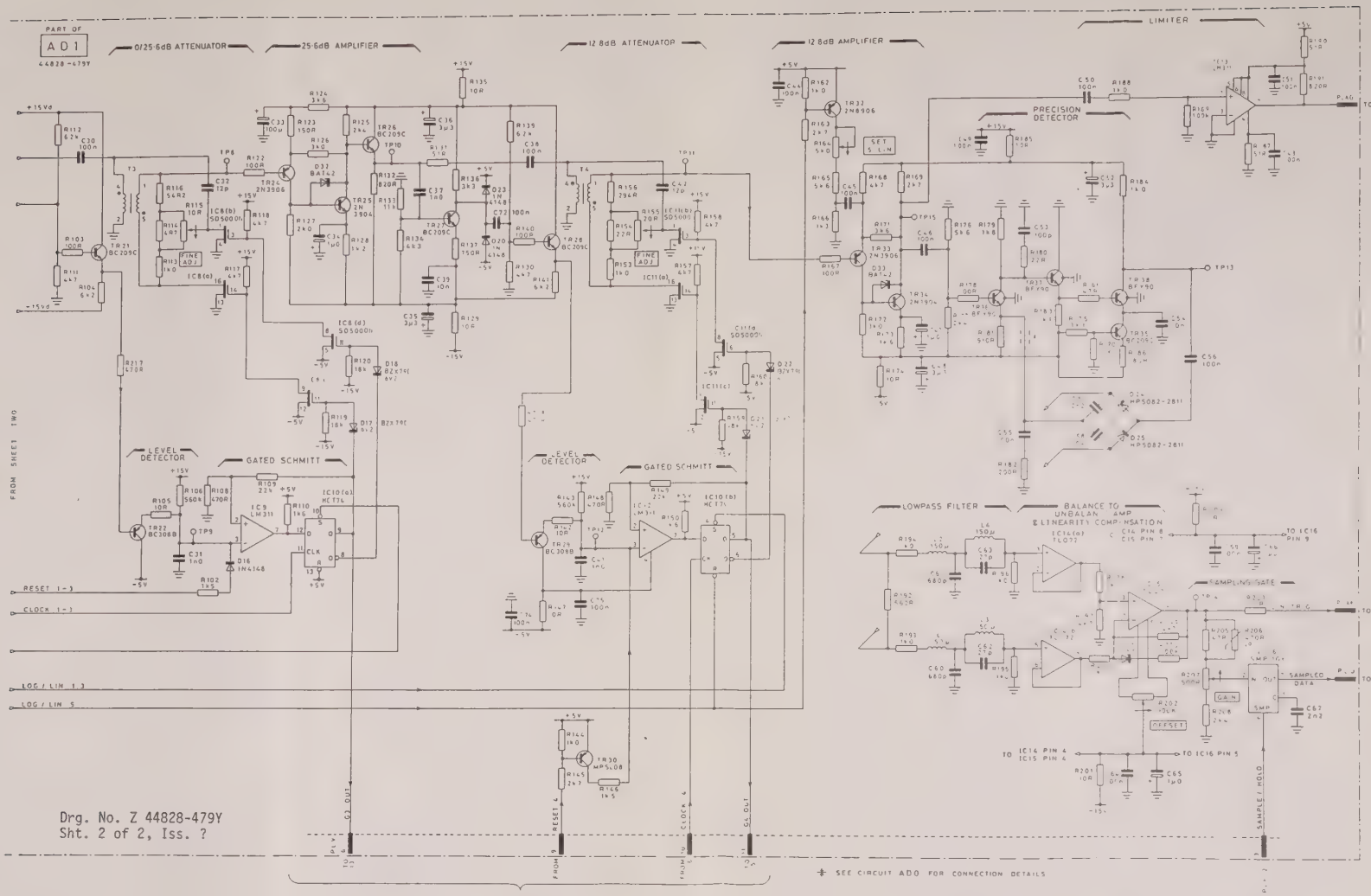



| SUPPLY LINE TABLE | | | |
|---|---|---|---|
| IC NUMBER | +5V | -5V | GROUND |
| IC2 | | 2 | |
| IC3 | 8 | 4 | 1 |
| IC4 | 14 | | 7 |
| IC5 | 14 | | 7 |
| IC6 | | 2 | |
| IC7 | 8 | 4 | 1 |
| IC8 | | 2 | |
| IC9 | 8 | 4 | 1 |
| IC10 | 14 | | 7 |
| IC11 | | 2 | |
| IC12 | 8 | | 1 |
| IC16 | | | 13 |

AD1 Log amplifier

Fig. 32

Sep. 87

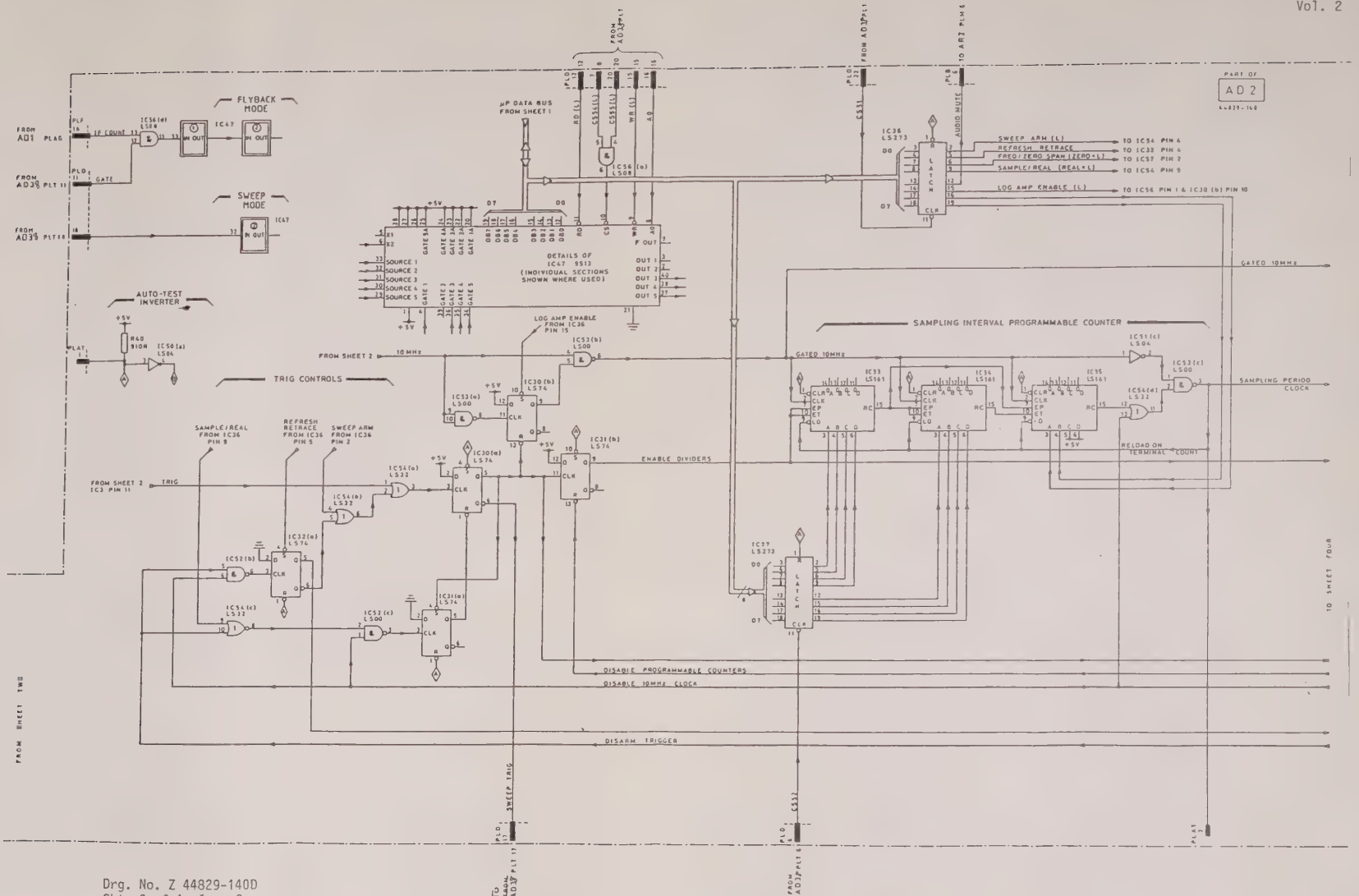



Drg. No. Z 44828-479Y
Sht. 2 of 2, Iss. ?

AD1 Log amplifier

Fig. 33

Sep. 87

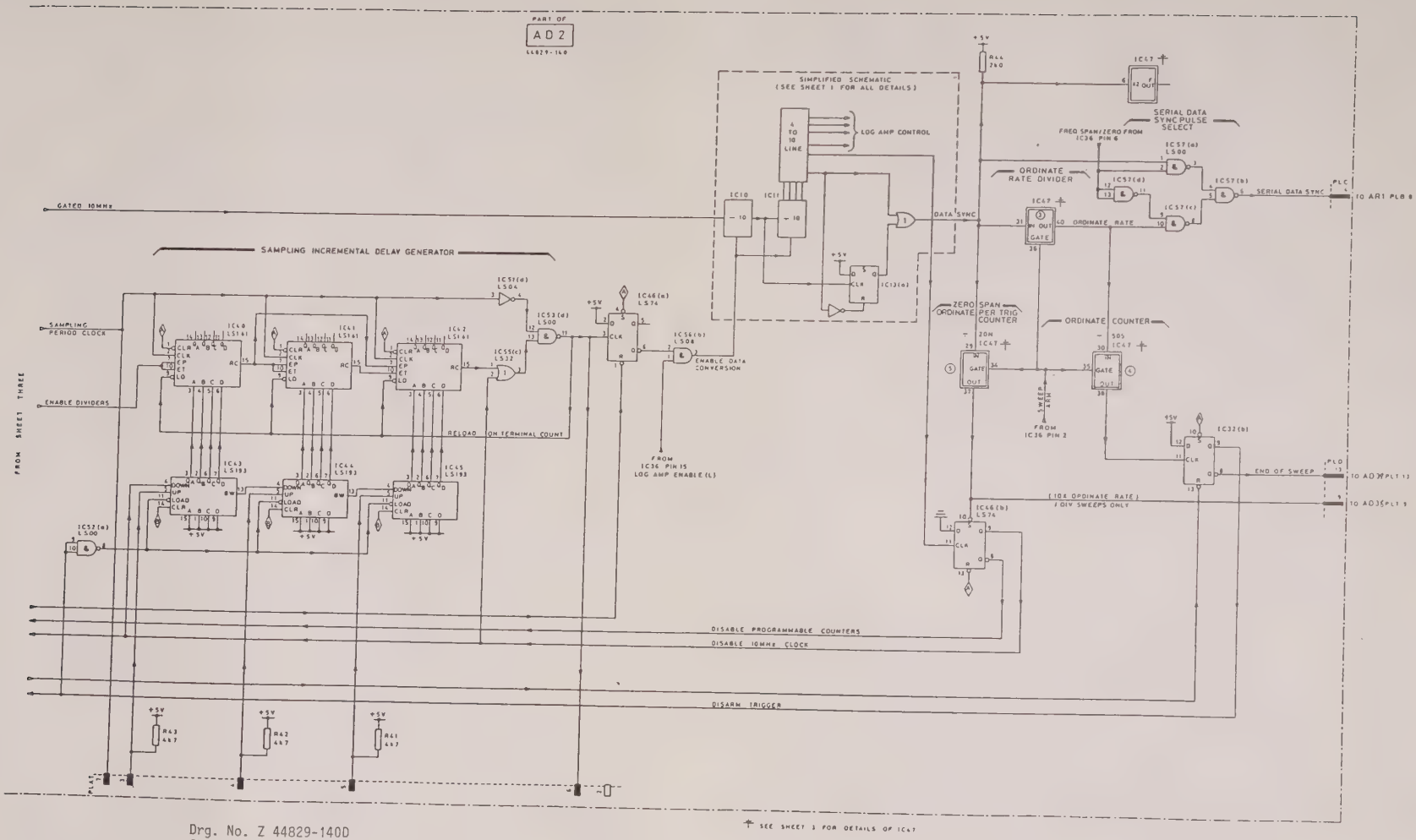



Drg. No. Z 44829-140D
Sht. 3 of 4, Iss. ?

Fig. 36

Sep. 87

AD2 Log amplifier interface

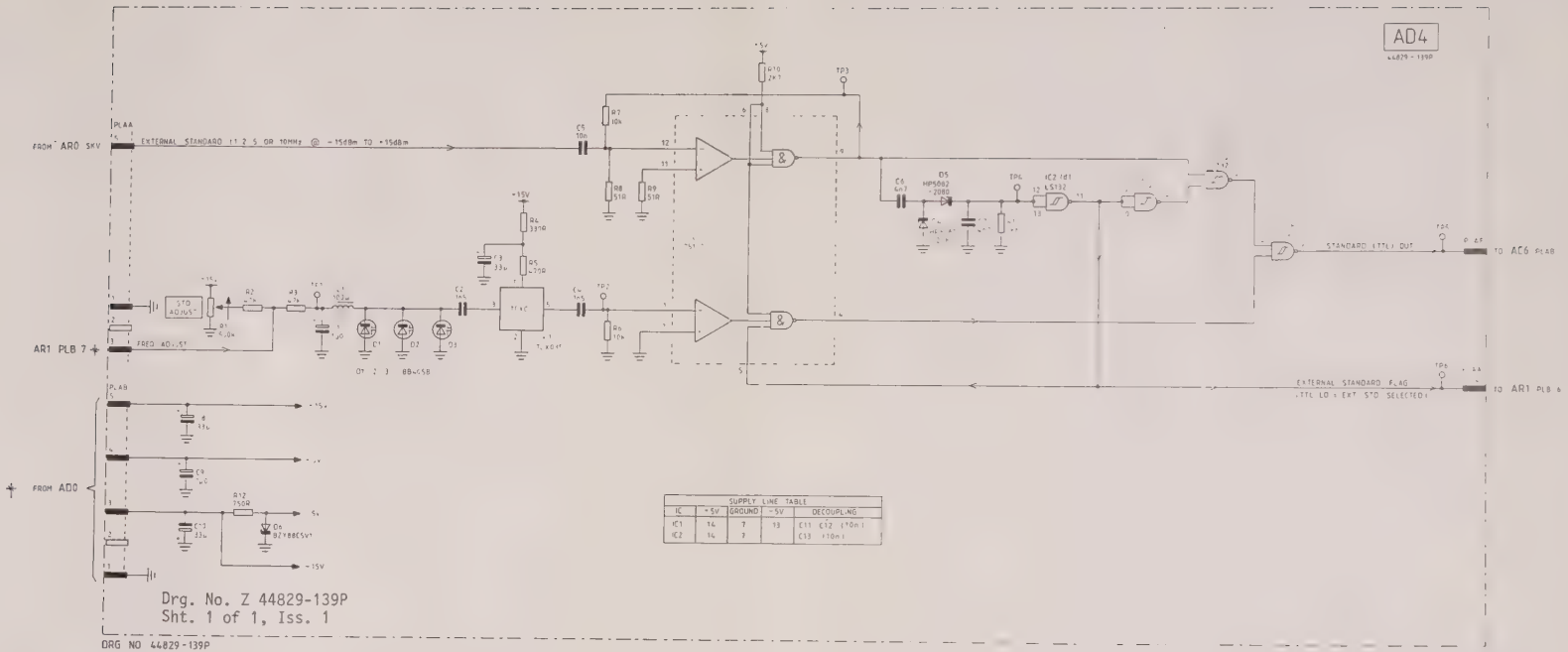


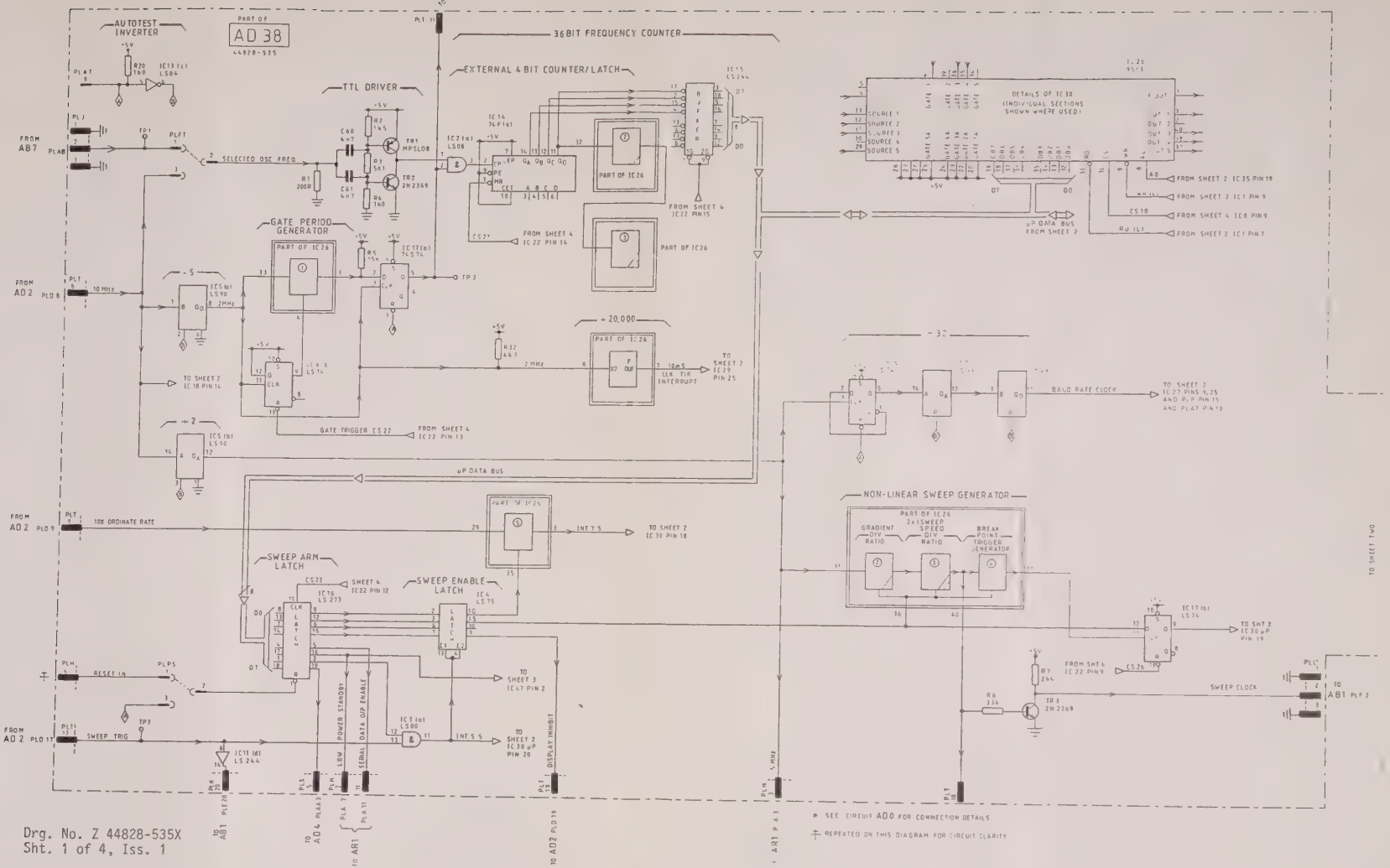

Drg. No. Z 44829-140D
Sht. 4 of 4, Iss. ?

Fig. 37

Sep. 87

AD2 Log amplifier interface


AD4
44829-139P
FROM AR0 5K7
EXTERNAL STANDARD 1 2 5 OR 10MHz @ -15dBm TO +15dBm
AR1 PLB 7
FROM AD0
STD ADJUST
FREQ ADJUST
STANDARD (TTL) OUT
TO AD6 PLAB
EXTERNAL STANDARD FLAG
(TTL LO = EXT STD SELECTED)
TO AR1 PLB 6
SUPPLY LINE TABLE
IC | +5V | GROUND | -5V | DECOUPLING
IC1 | 14 | 7 | 13 | C11 C12 100n
IC2 | 14 | 7 | | C13 100n
Drg. No. Z 44829-139P
Sht. 1 of 1, Iss. 1
DRG NO 44829-139P




Drg. No. Z 44828-535X
Sht. 1 of 4, Iss. 1

Fig. 39

AD38 Microprocessor

Sep. 87

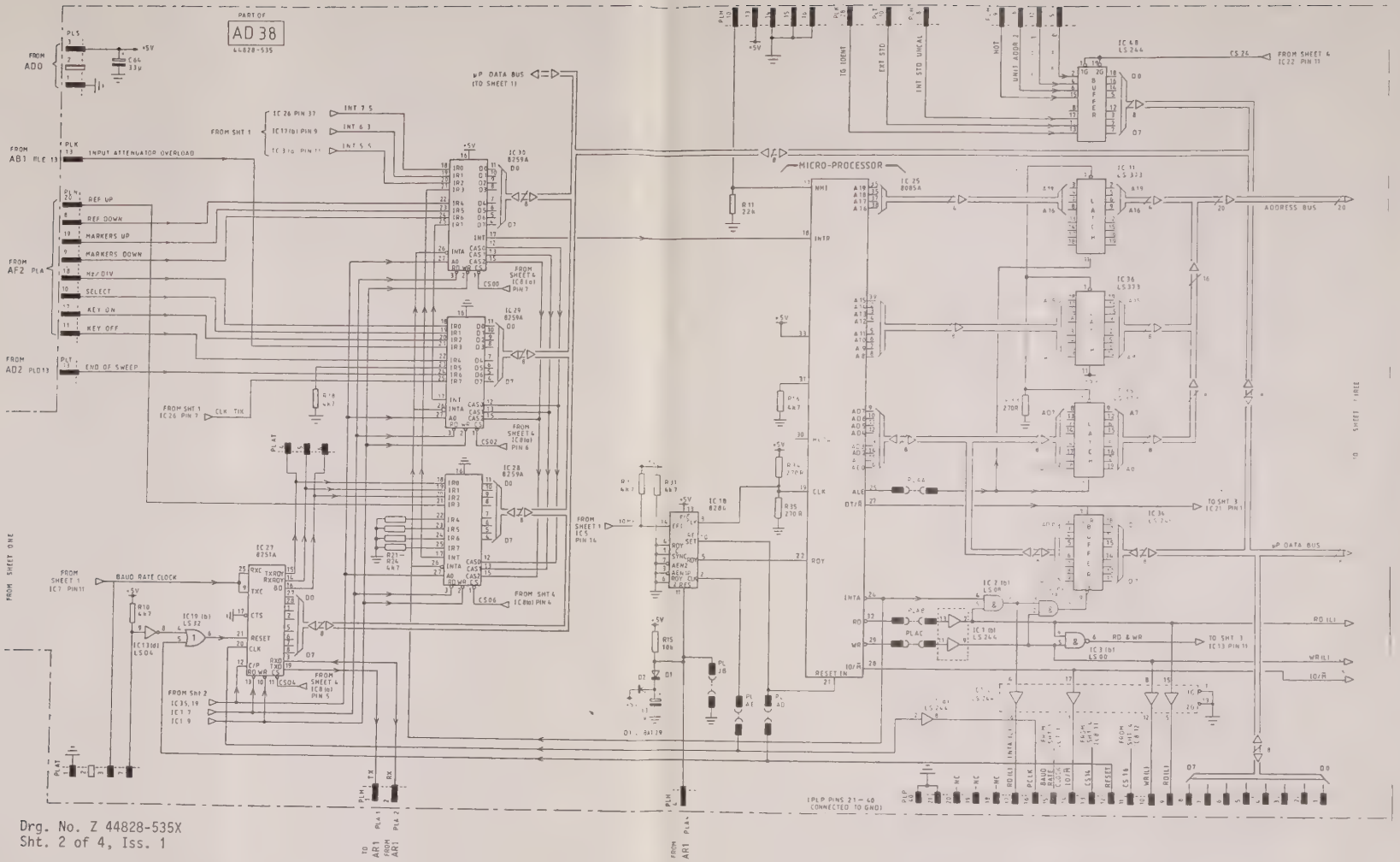
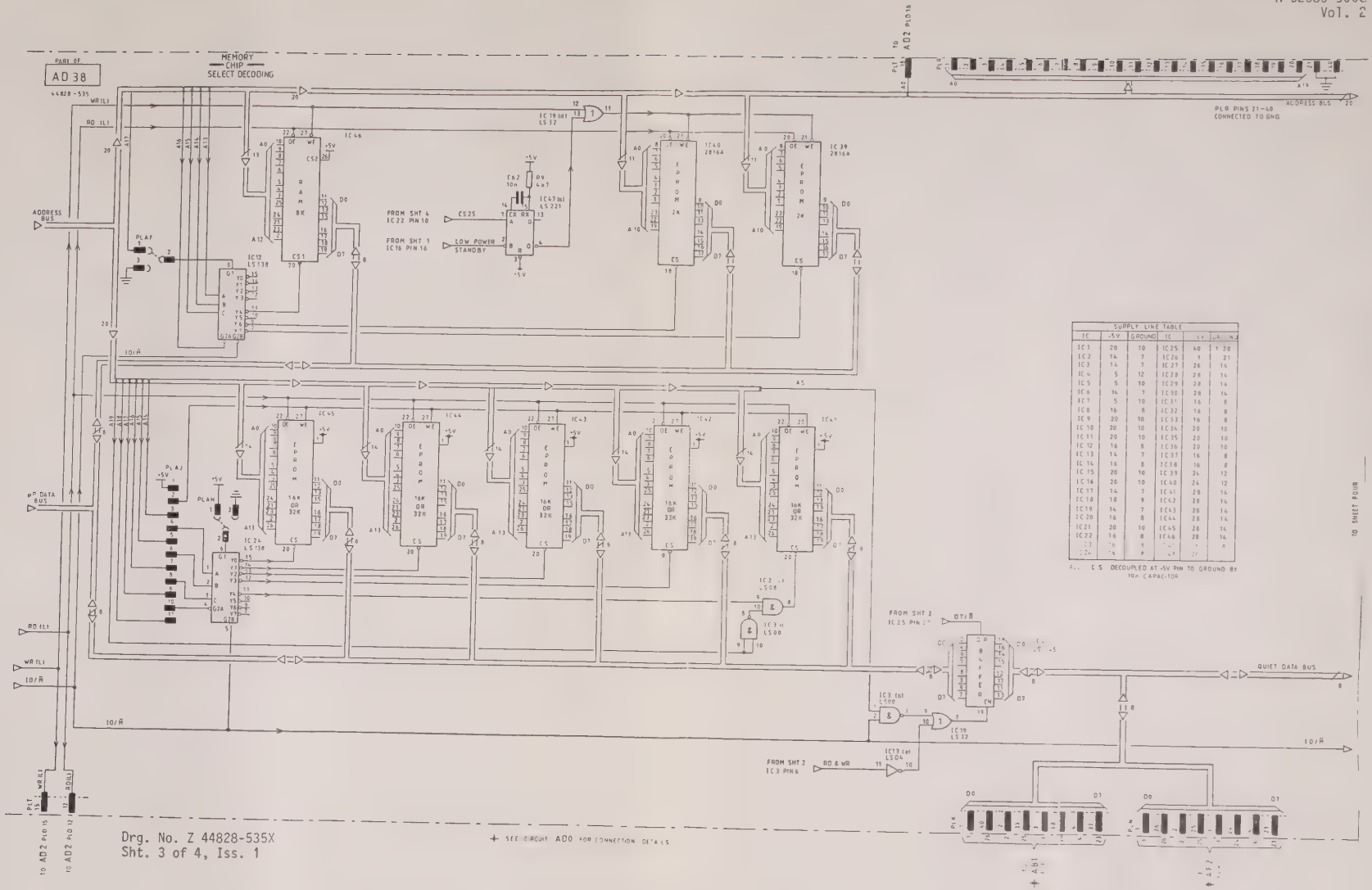



Fig. 40

AD38 Microprocessor

Sep. 87



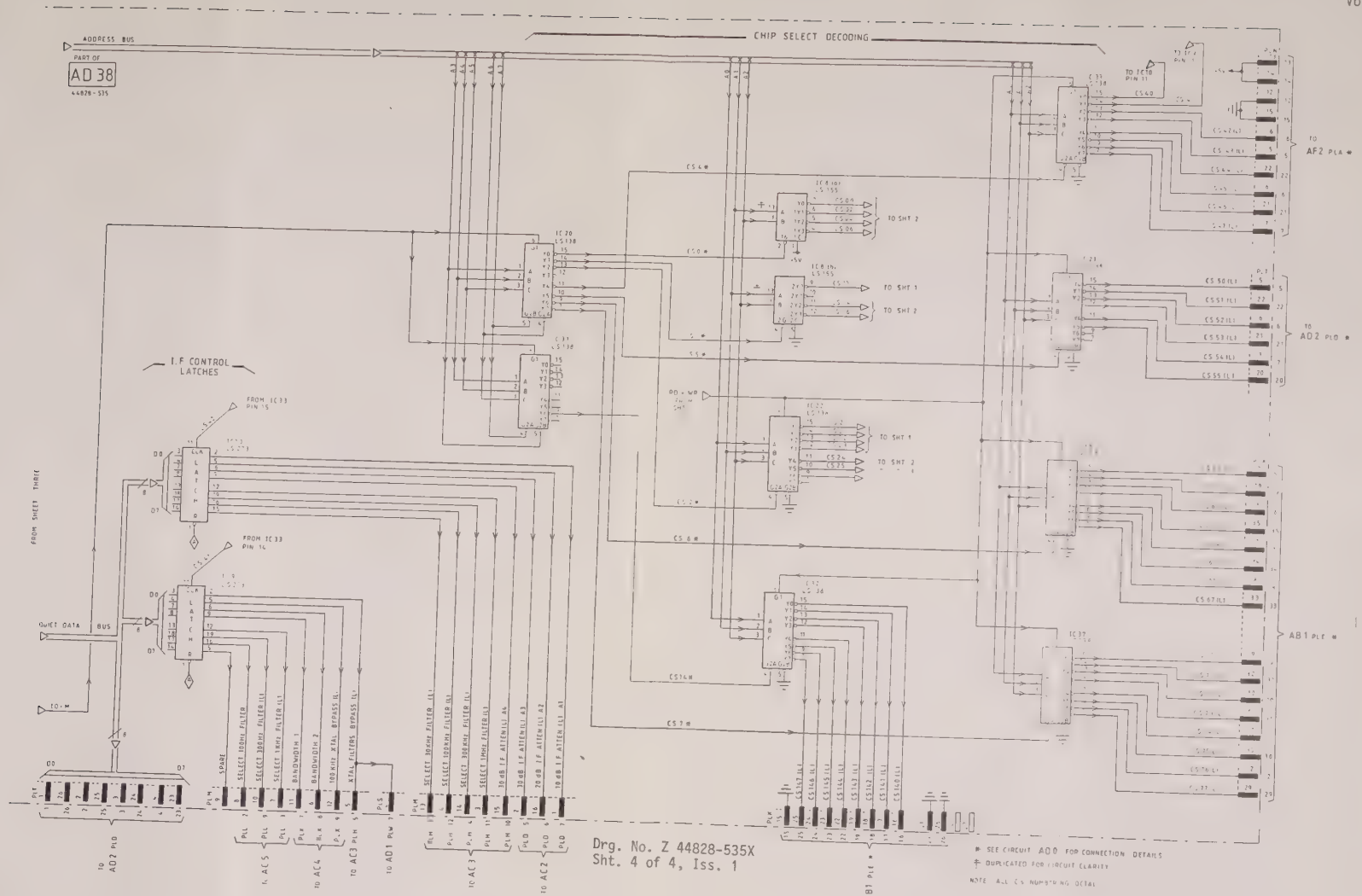

| SUPPLY LINE TABLE | | | | | | |
|---|---|---|---|---|---|---|
| IC | +5V | GROUND | IC | +5V | GROUND | |
| IC 1 | 20 | 10 | IC 25 | 40 | 1 | 20 |
| IC 2 | 14 | 7 | IC 26 | 1 | 21 | |
| IC 3 | 14 | 7 | IC 27 | 26 | 14 | |
| IC 4 | 5 | 12 | IC 28 | 28 | 14 | |
| IC 5 | 5 | 10 | IC 29 | 28 | 14 | |
| IC 6 | 14 | 7 | IC 30 | 28 | 14 | |
| IC 7 | 5 | 10 | IC 31 | 16 | 8 | |
| IC 8 | 16 | 8 | IC 32 | 16 | 8 | |
| IC 9 | 20 | 10 | IC 33 | 16 | 8 | |
| IC 10 | 20 | 10 | IC 34 | 20 | 10 | |
| IC 11 | 20 | 10 | IC 35 | 20 | 10 | |
| IC 12 | 16 | 8 | IC 36 | 20 | 10 | |
| IC 13 | 14 | 7 | IC 37 | 16 | 8 | |
| IC 14 | 16 | 8 | IC 38 | 16 | 8 | |
| IC 15 | 20 | 10 | IC 39 | 24 | 12 | |
| IC 16 | 20 | 10 | IC 40 | 24 | 12 | |
| IC 17 | 14 | 7 | IC 41 | 28 | 14 | |
| IC 18 | 18 | 9 | IC 42 | 28 | 14 | |
| IC 19 | 14 | 7 | IC 43 | 28 | 14 | |
| IC 20 | 16 | 8 | IC 44 | 28 | 14 | |
| IC 21 | 20 | 10 | IC 45 | 28 | 14 | |
| IC 22 | 16 | 8 | IC 46 | 28 | 14 | |
| [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | [illegible] | |

[illegible] C S DECOUPLED AT +5V PIN TO GROUND BY 10n CAPACITOR

Fig. 41

Sep. 87

AD38 Microprocessor

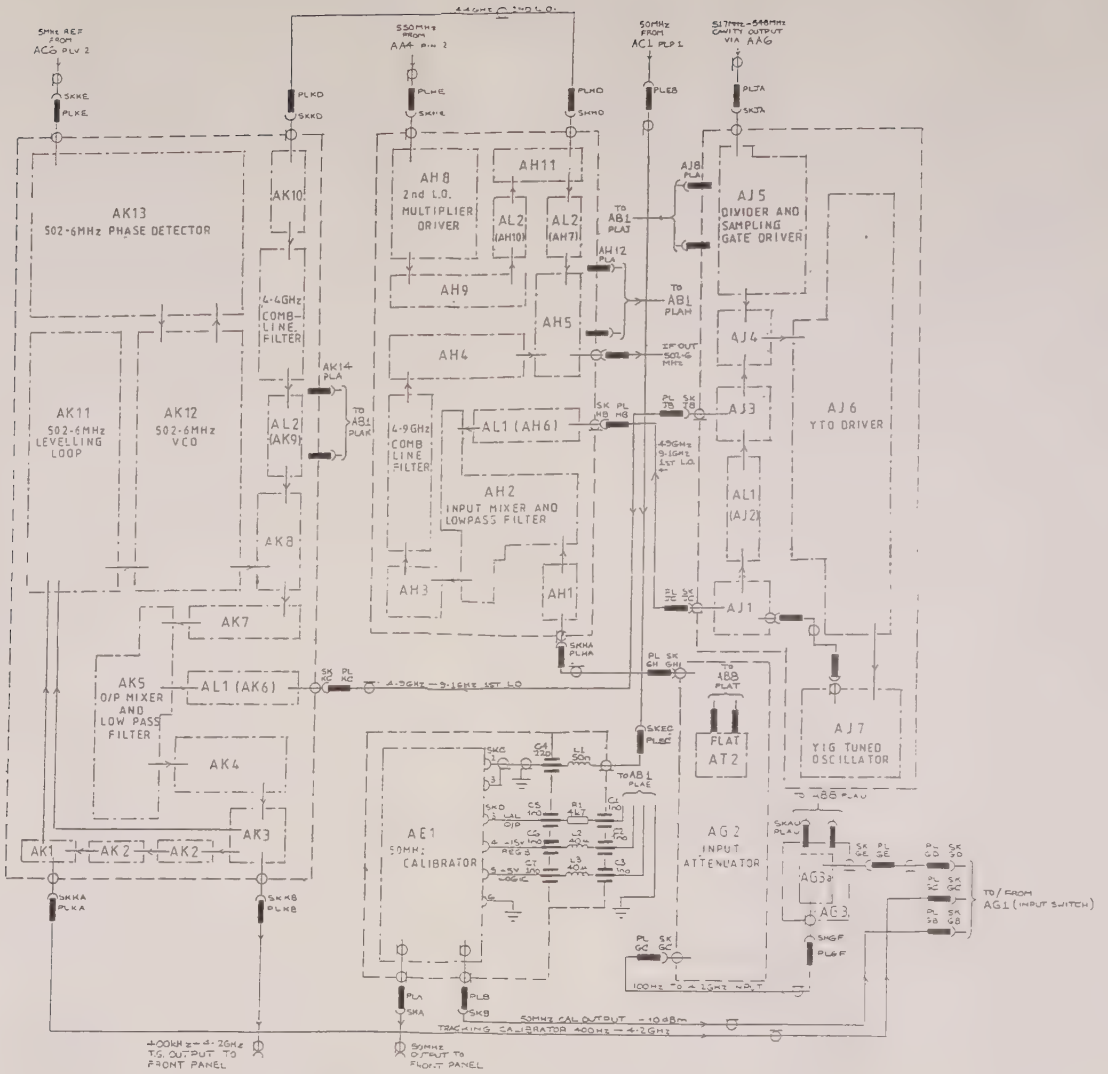



Drg. No. Z 44828-535X
Sht. 4 of 4, Iss. 1

Fig. 42

Sep. 87

AD38 Microprocessor

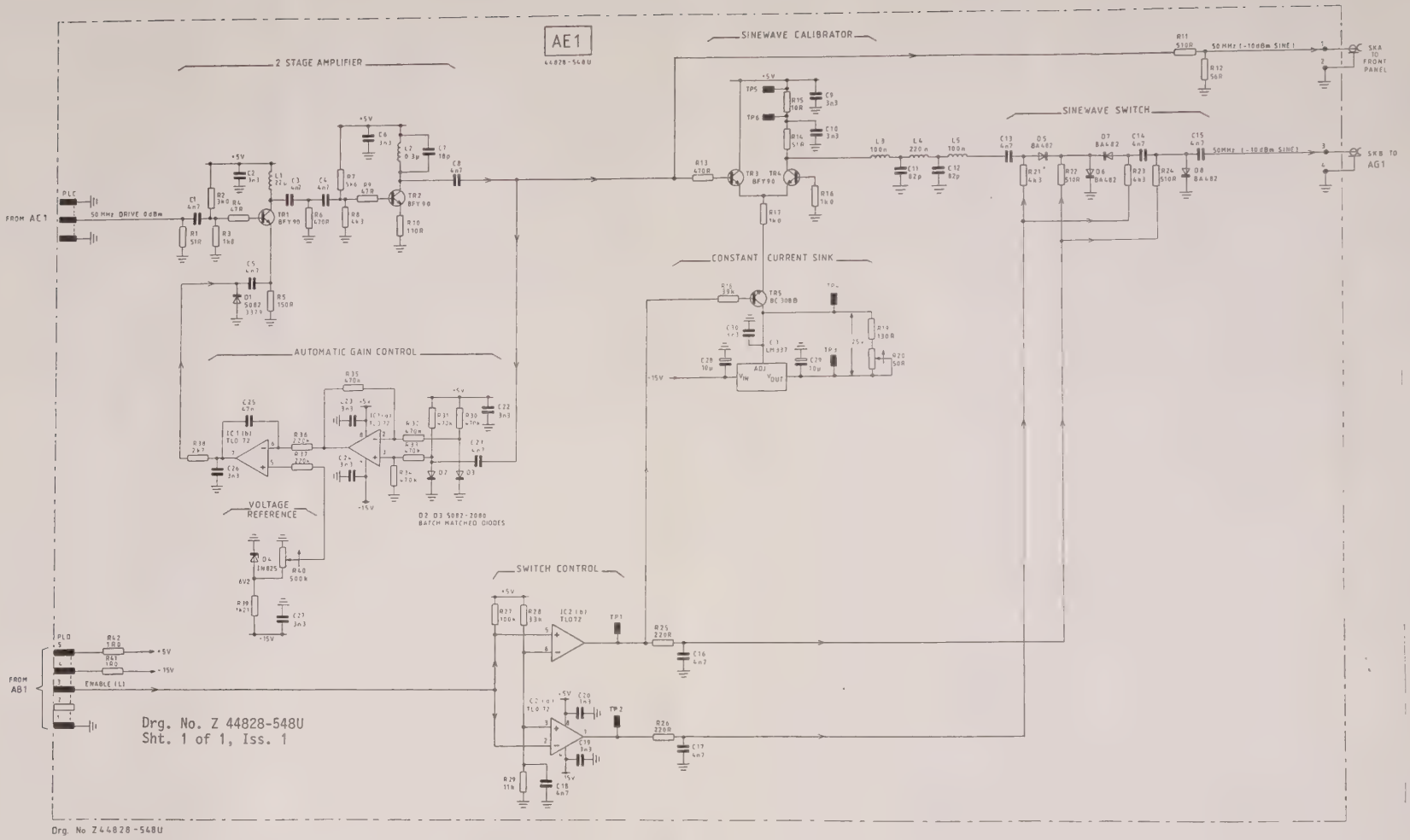



AE0 AE tray interconnections

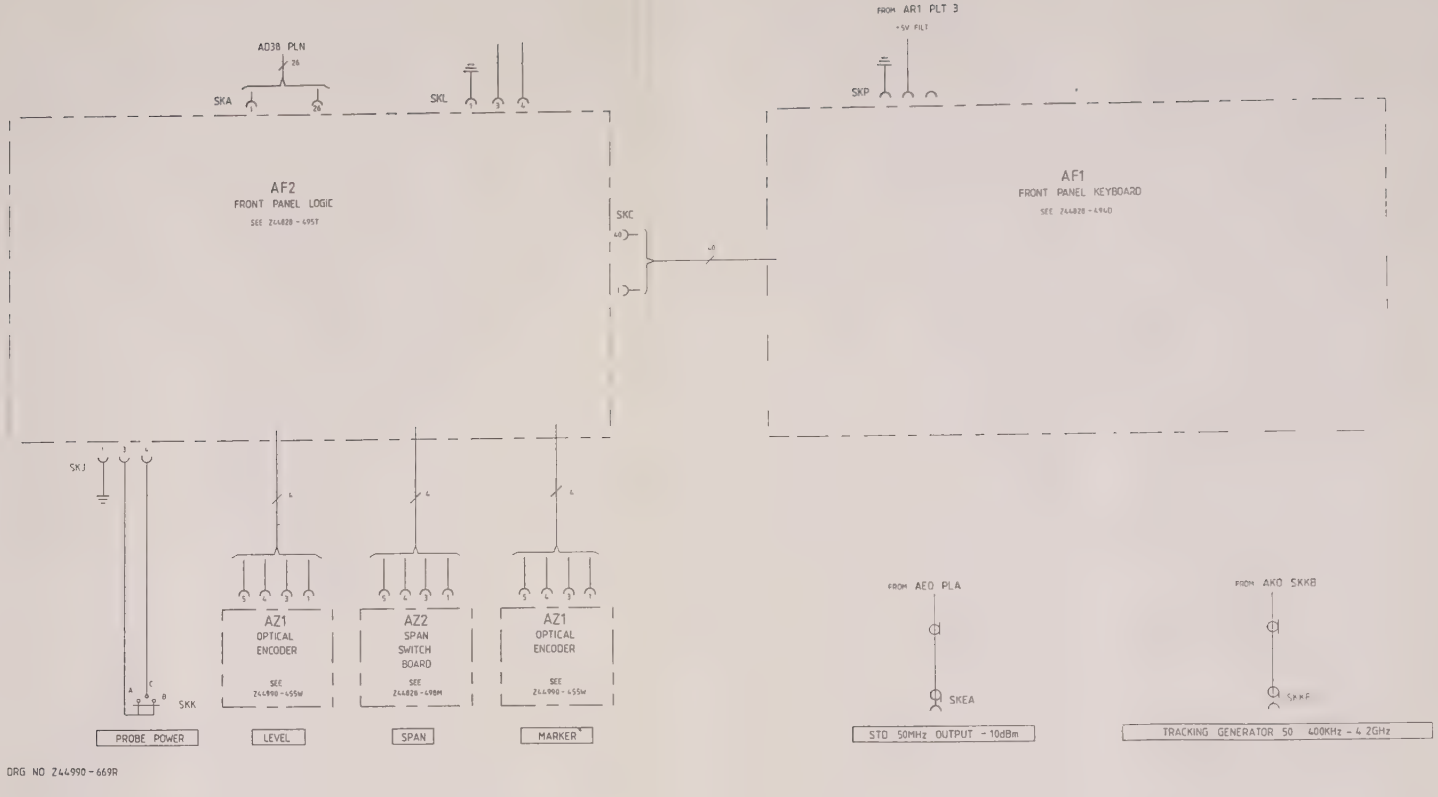
Drg. No. Z 44990-663D
Sht. 3 of 3, Iss. 1

Fig. 43

Sep. 87




AE1 50 MHz calibrator




Drg. No. Z 44990-669R
Sht. 1 of 1, Iss. 1

AF0 Front panel interconnections

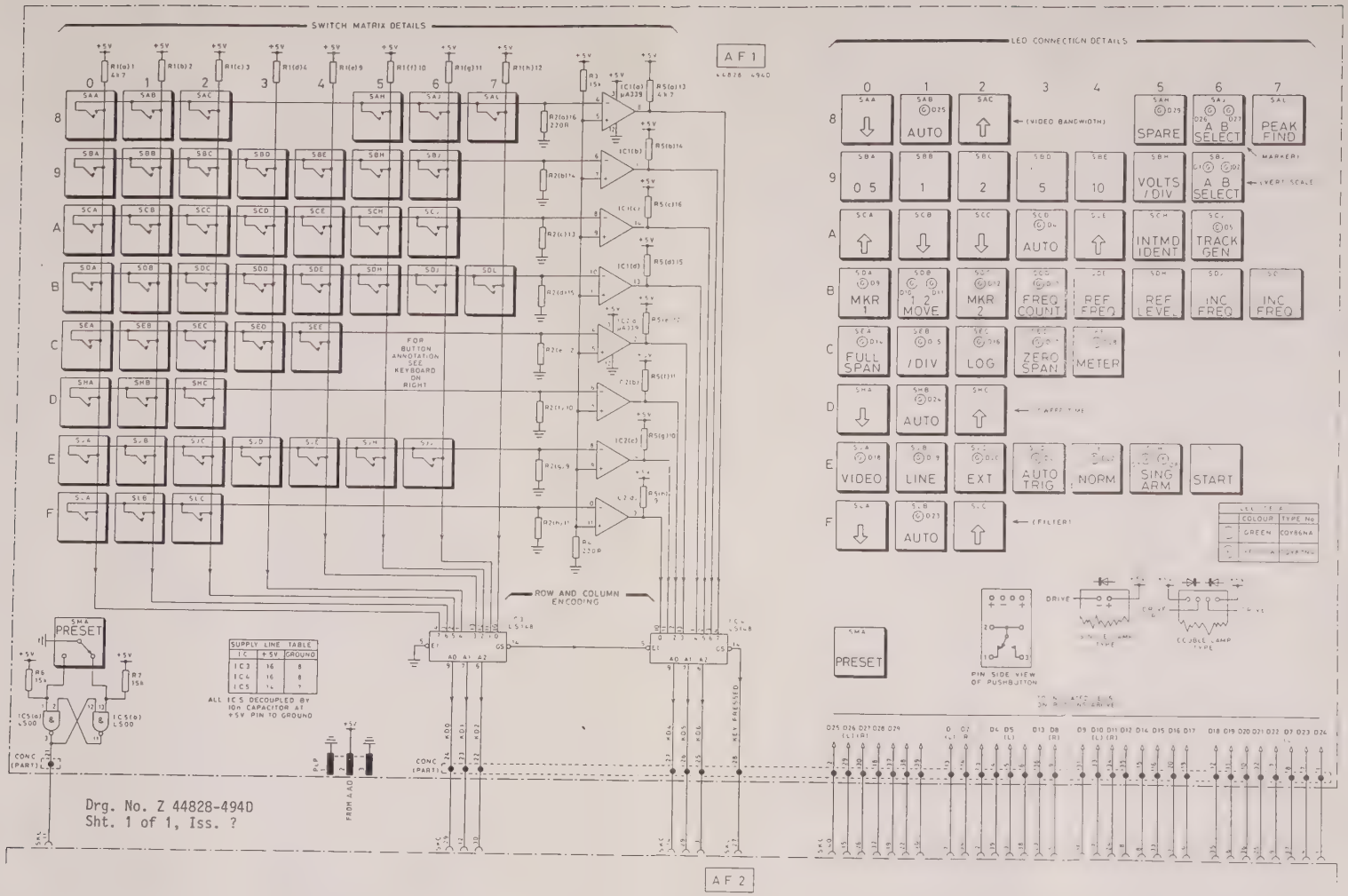
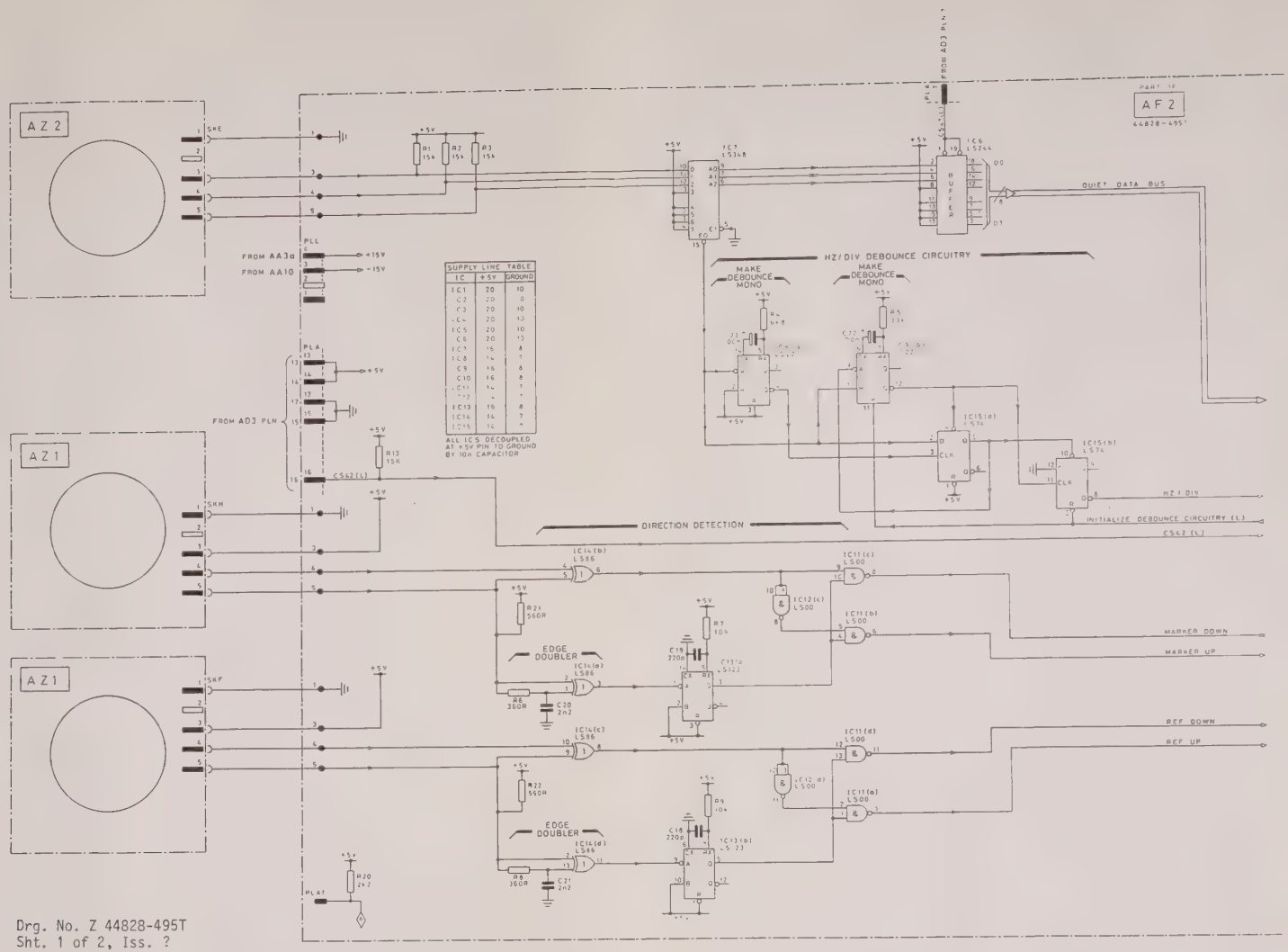



Fig. 46

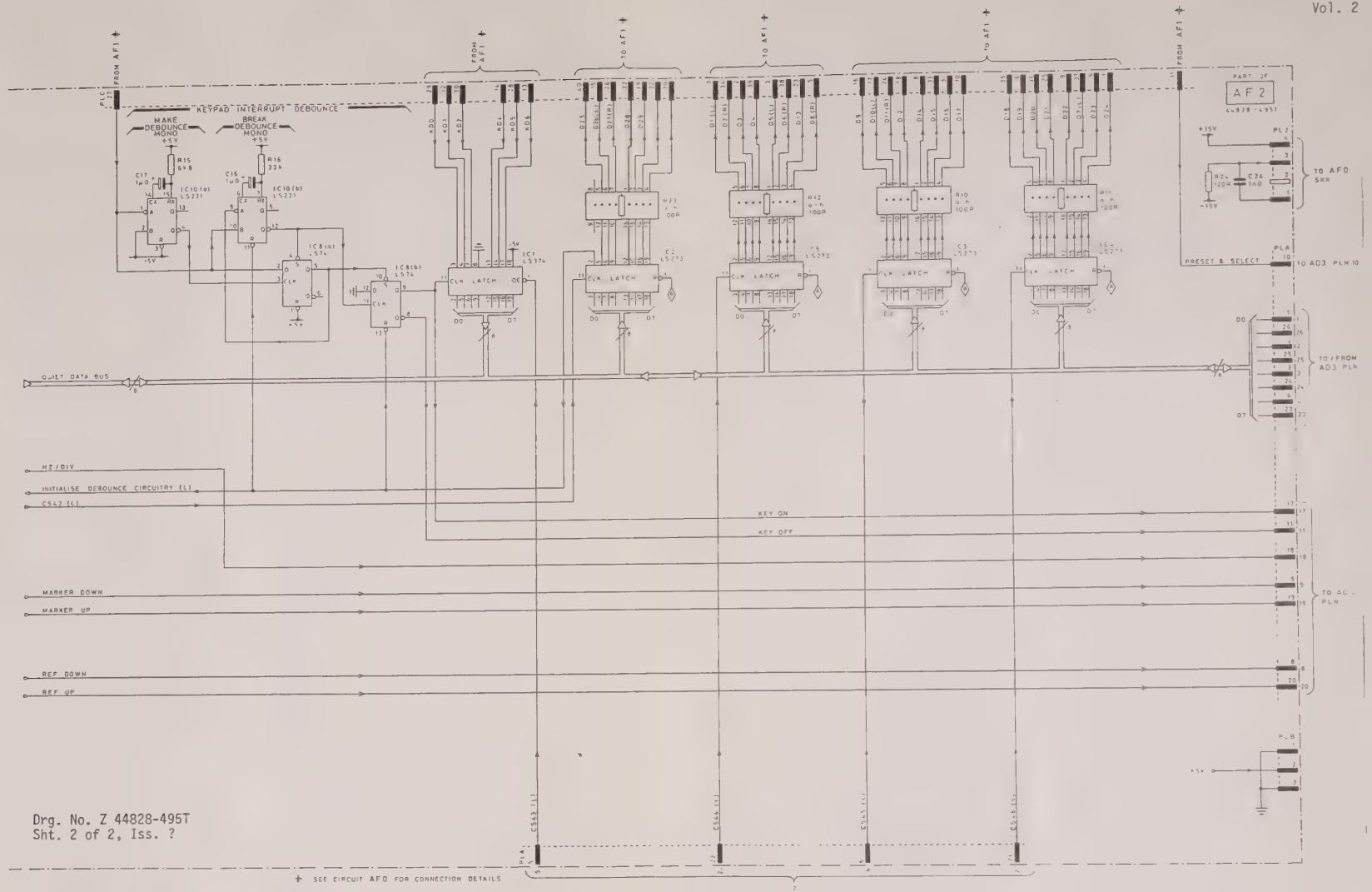
AF1 Front panel keyboard

Sep. 87



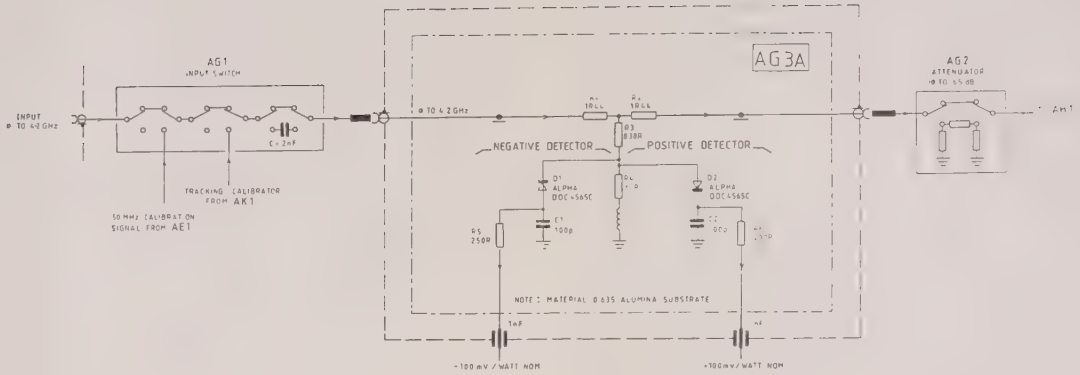

Drg. No. Z 44828-495T
Sht. 1 of 2, Iss. ?

AF2 Front panel logic
AZ1 Optical encoder
AZ2 Sweep span switch




Drg. No. Z 44828-495T
Sht. 2 of 2, Iss. ?

AF 2 Front panel logic

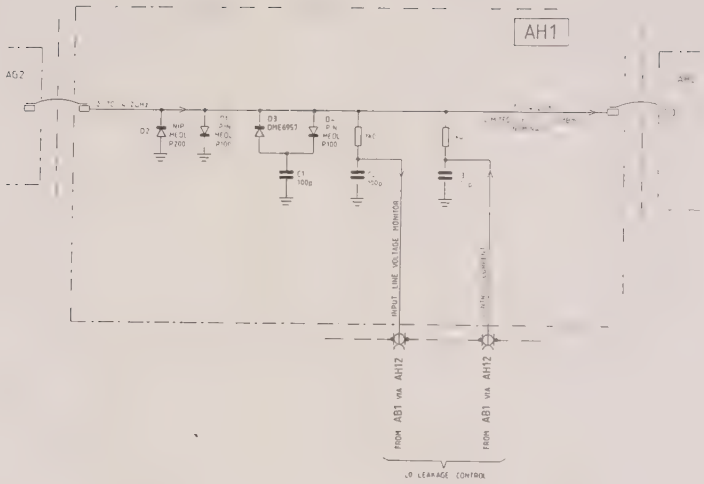



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

Fig. 49

Sep. 87

AG1 Input switch
AG2 Input attenuator
AG3 Power protection pick-off assembly

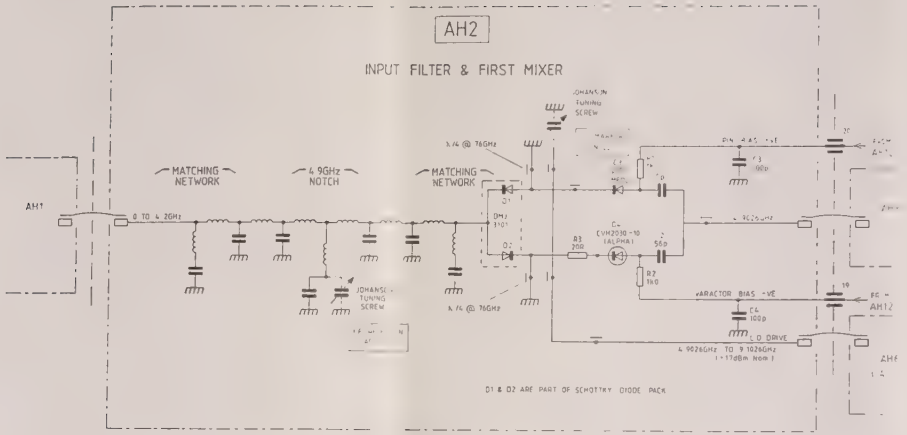



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

Fig. 50

Sep. 87

AH1 Mixer voltage limiter

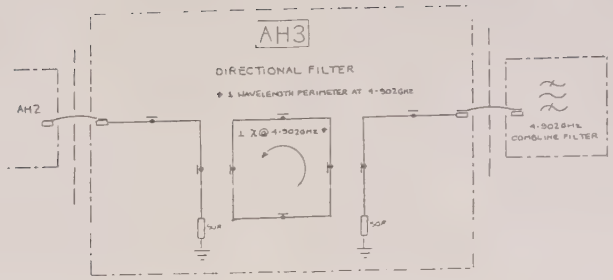



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

Fig. 51

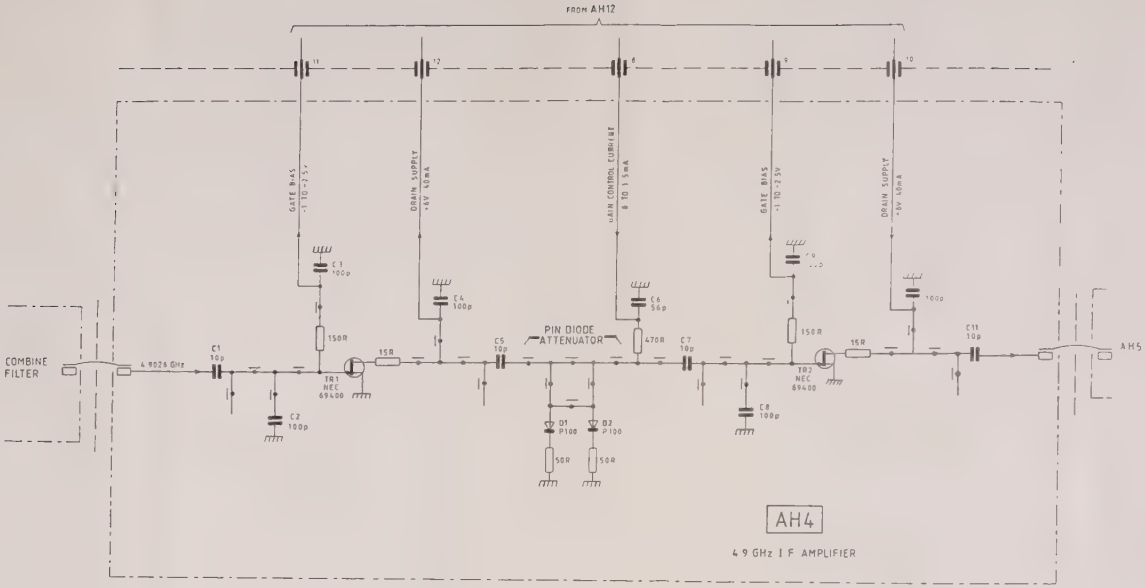
Sep. 87

AH2 Input filter and 1st mixer




Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

AH3 Directional filter

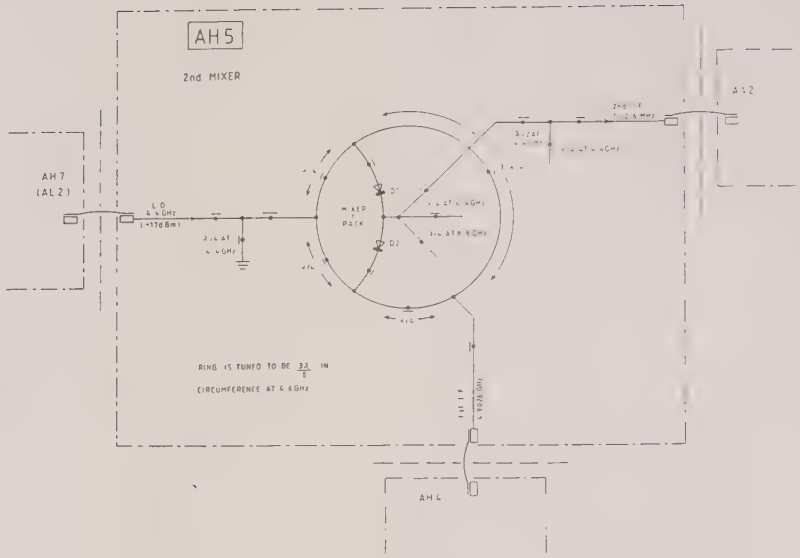



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

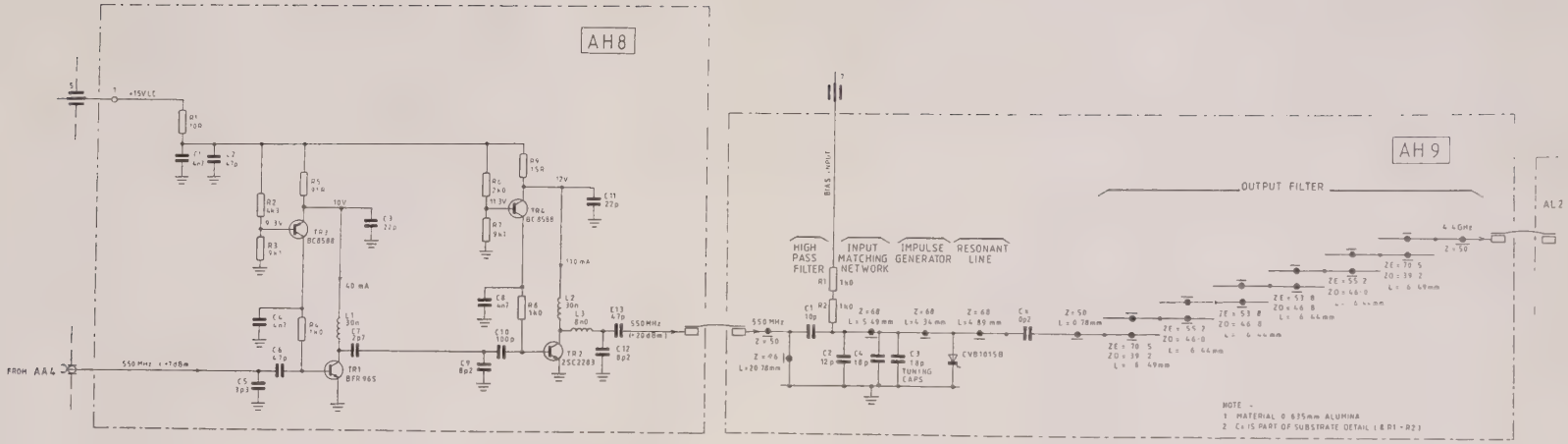
Fig. 53

Sep. 87

AH4 4.9 GHz i.f. amplifier

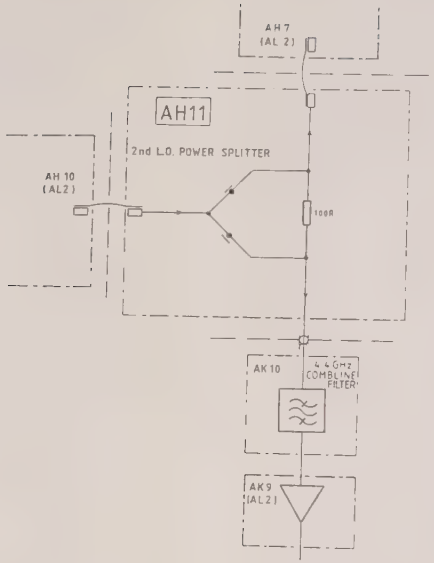



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1




Drg. No. Z 44990-666X
Sht. 1 of 1, Iss. 4

AH8 2nd l.o. multiplier driver
AH9 2nd l.o. multiplier

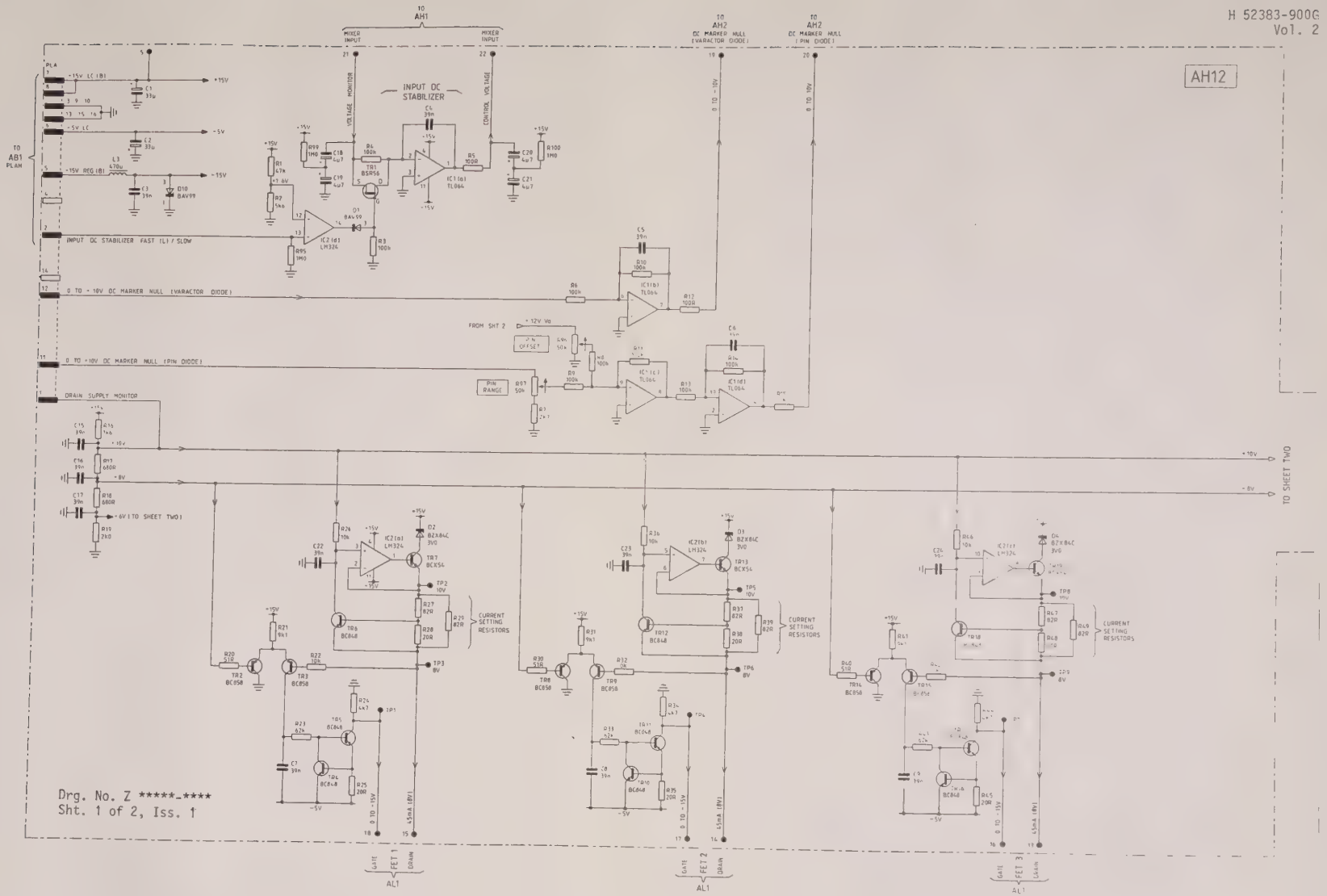



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

Fig. 56

Sep. 87

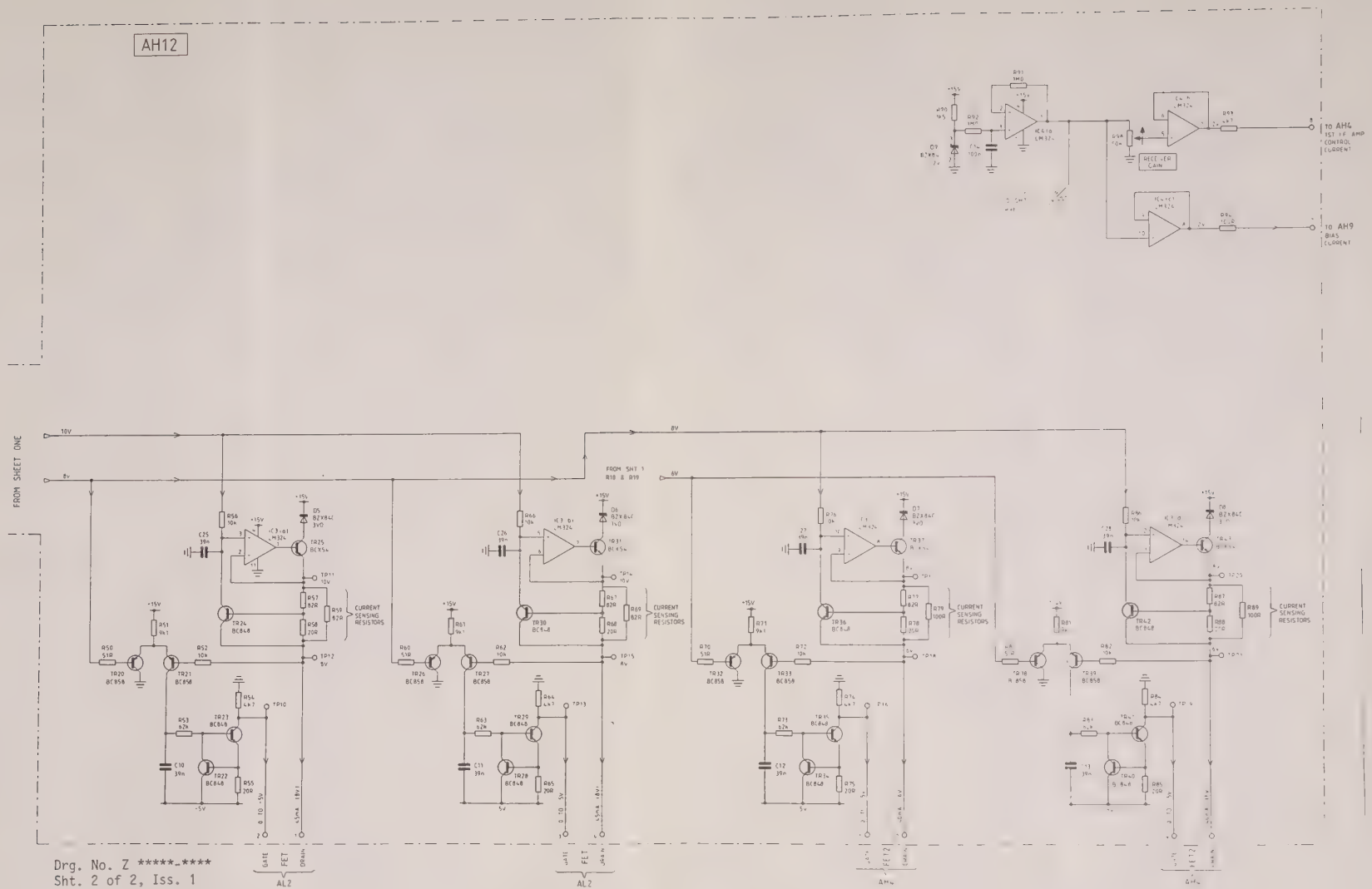
AH11 2nd l.o. power splitter



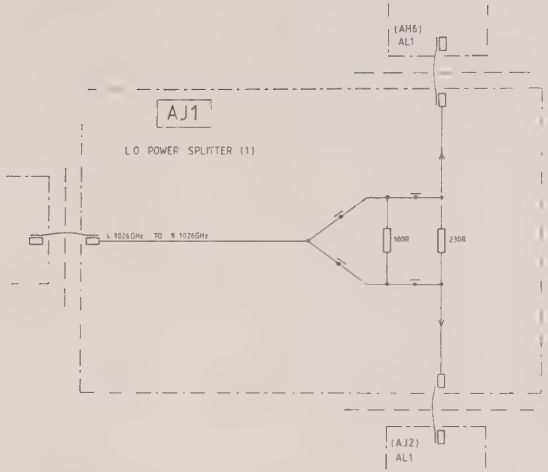

AH12 Receiver p.s.u. distribution

Fig. 57

Sep. 87

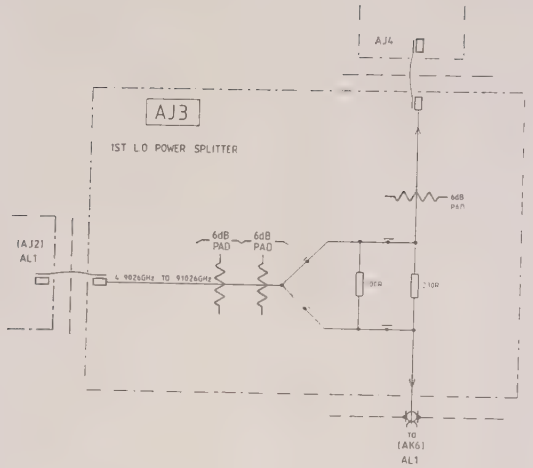



AH12 Receiver p.s.u. distribution




Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

AJ1 1st l.o. power splitter

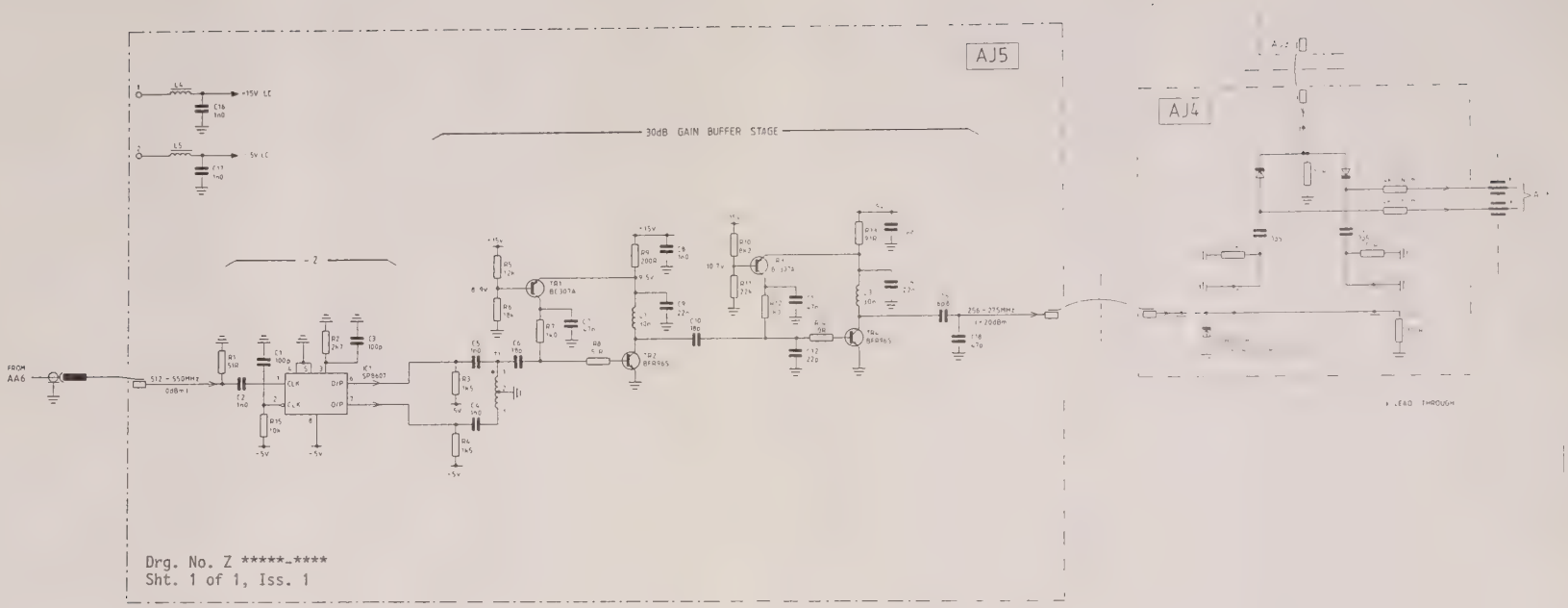



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

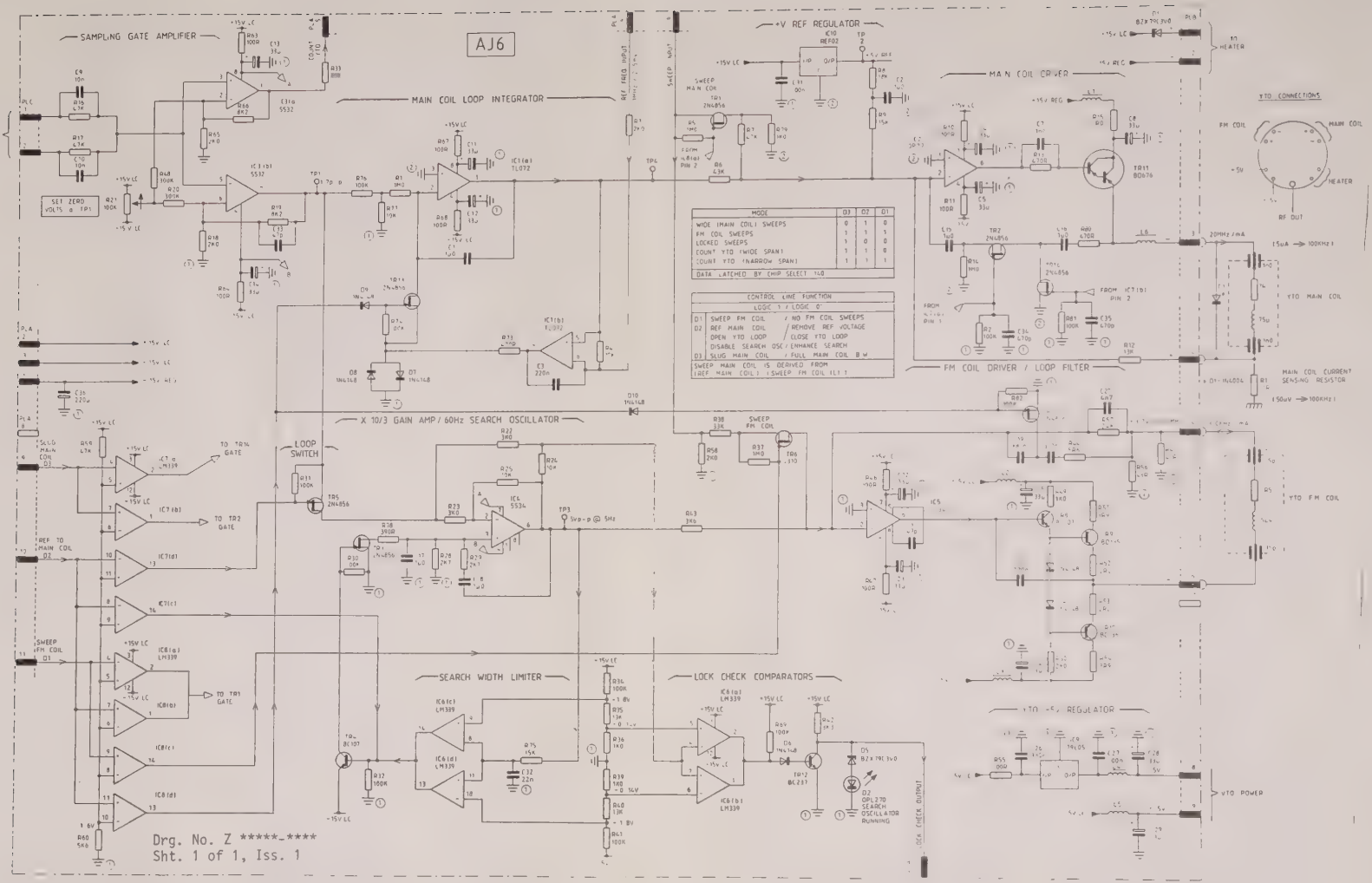
Fig. 60

Sep. 87

AJ3 1st l.o. power splitter




AJ4/1 1st l.o. sampling gate
AJ5 Sampling gate driver




AJ6/1 YTO driver
AJ7 YTO

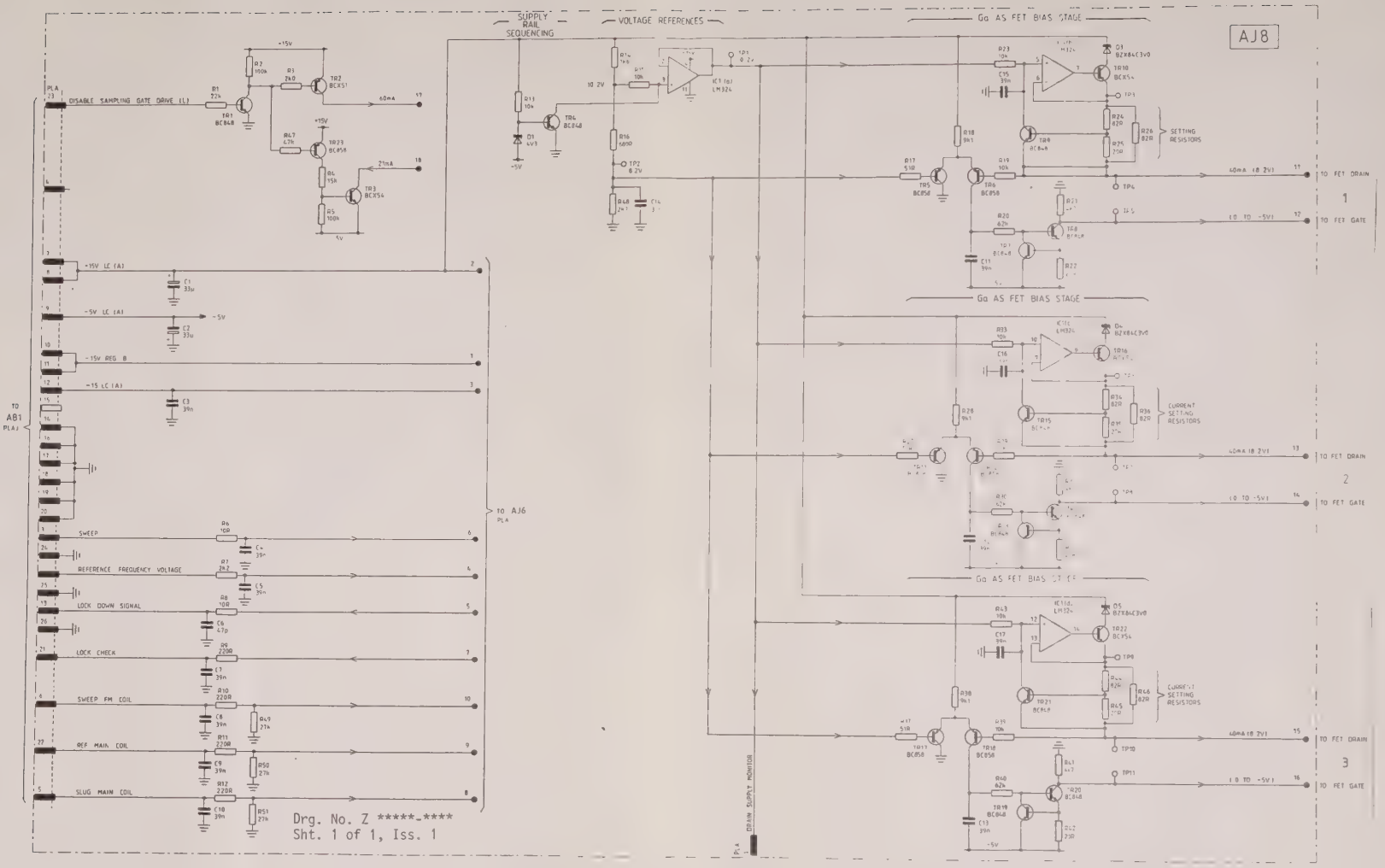
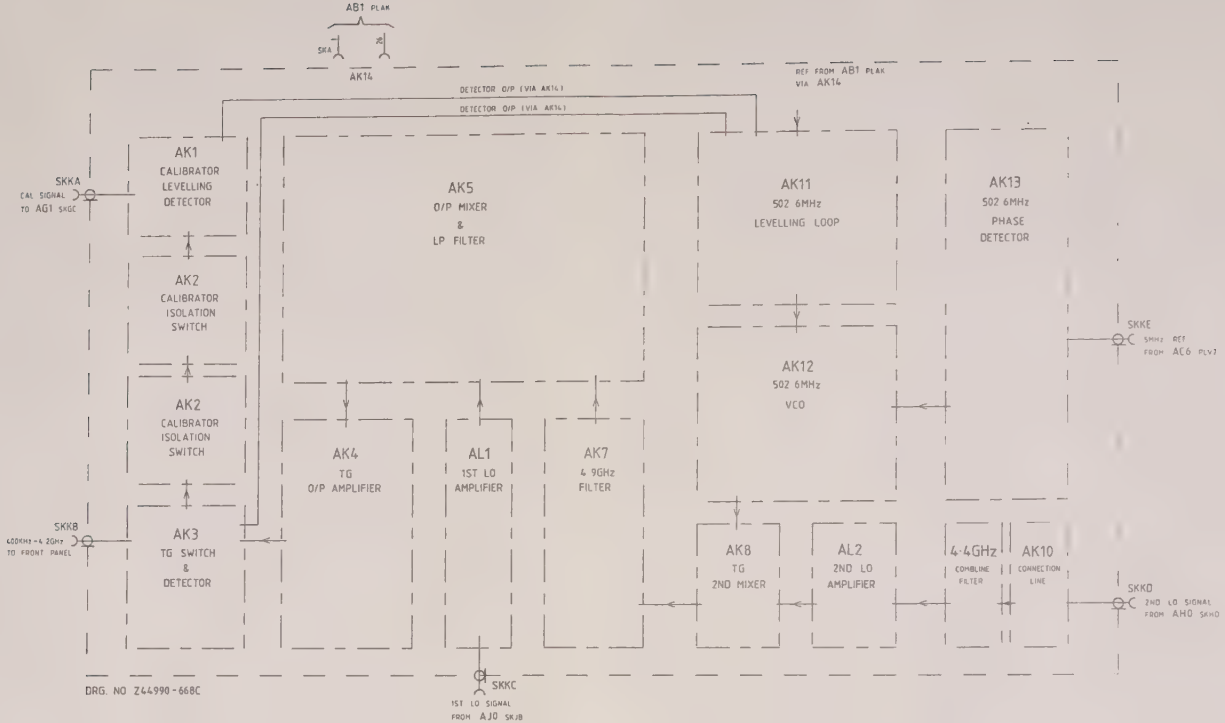



Fig. 63

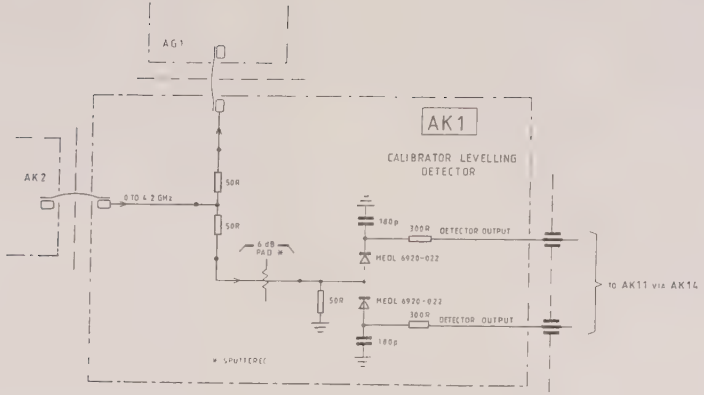
AJ8 1st l.o. bias board

Fig. 63



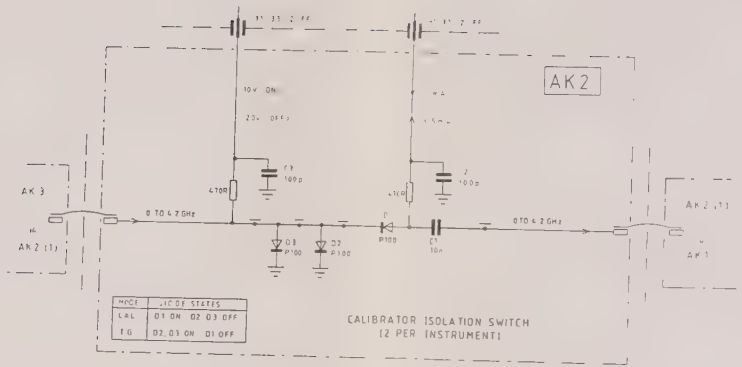

Drg. No. Z 44990-668C
Sht. 1 of 1, Iss. 1

AK0 Tracking generator assembly




Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

AK1 Calibrator levelling detector

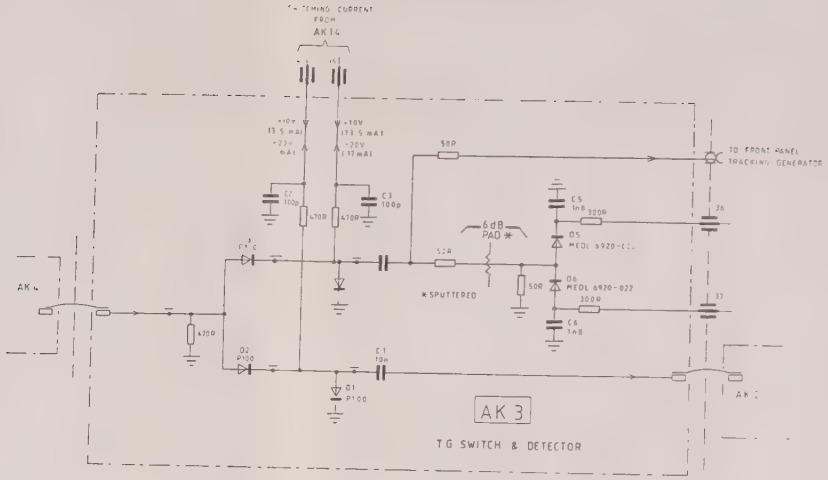



Drg. No. Z *****_****
Sht. 1 of 1, Iss. 1

Fig. 66

AK2 Calibrator isolation switch

Sep. 87

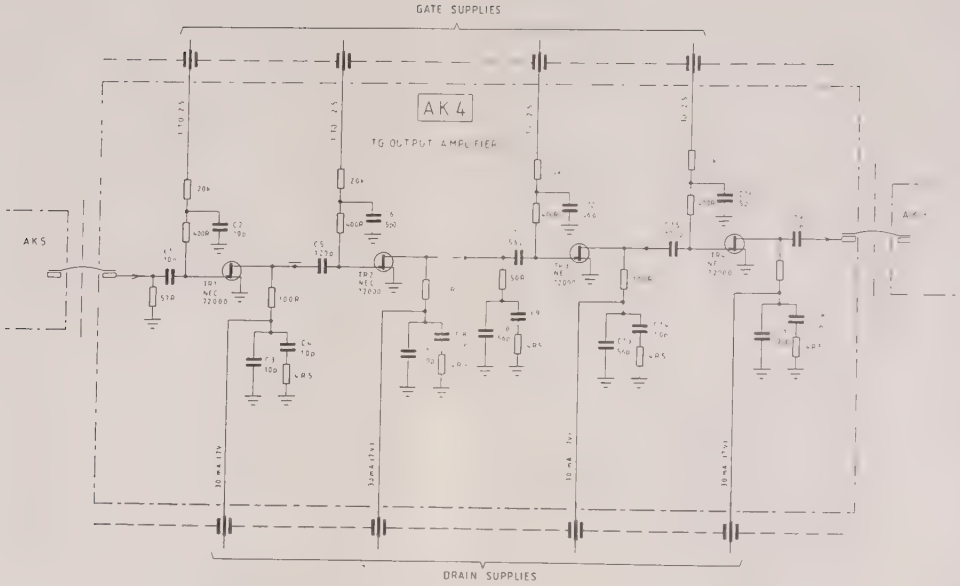



Drg. No. Z *****_****
Sht. 1 of 1, Iss. 1

Fig. 67

Sep. 87

AK3 TG switch and detector

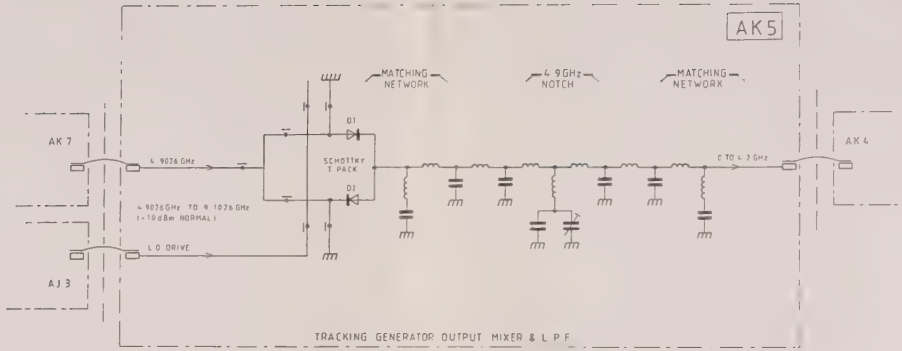



Drg. No. Z *****_****
Sht. 1 of 1, Iss. 1

Fig. 68

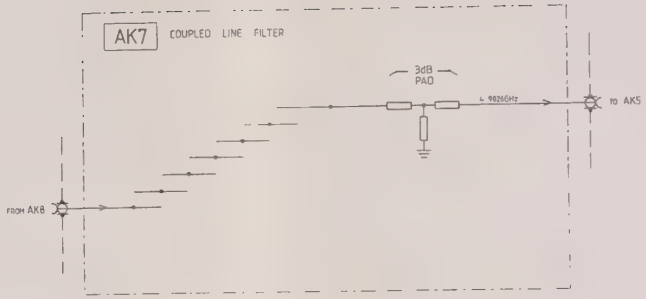
Sep. 87

AK4 TG output amplifier




Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

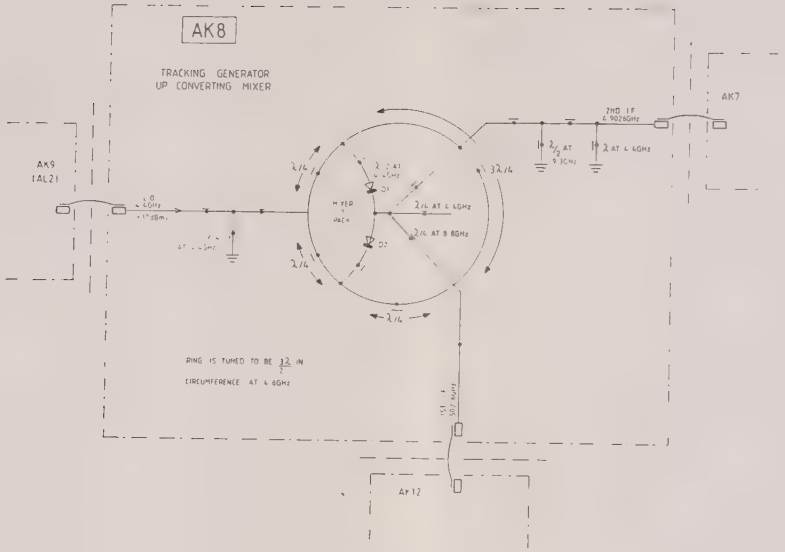
AK5 TG output mixer and l.p. filter




Drg. No. Z *****_****
Sht. 1 of 1, Iss. 1

AK7 4.9 GHz coupled-line filter

Fig. 70

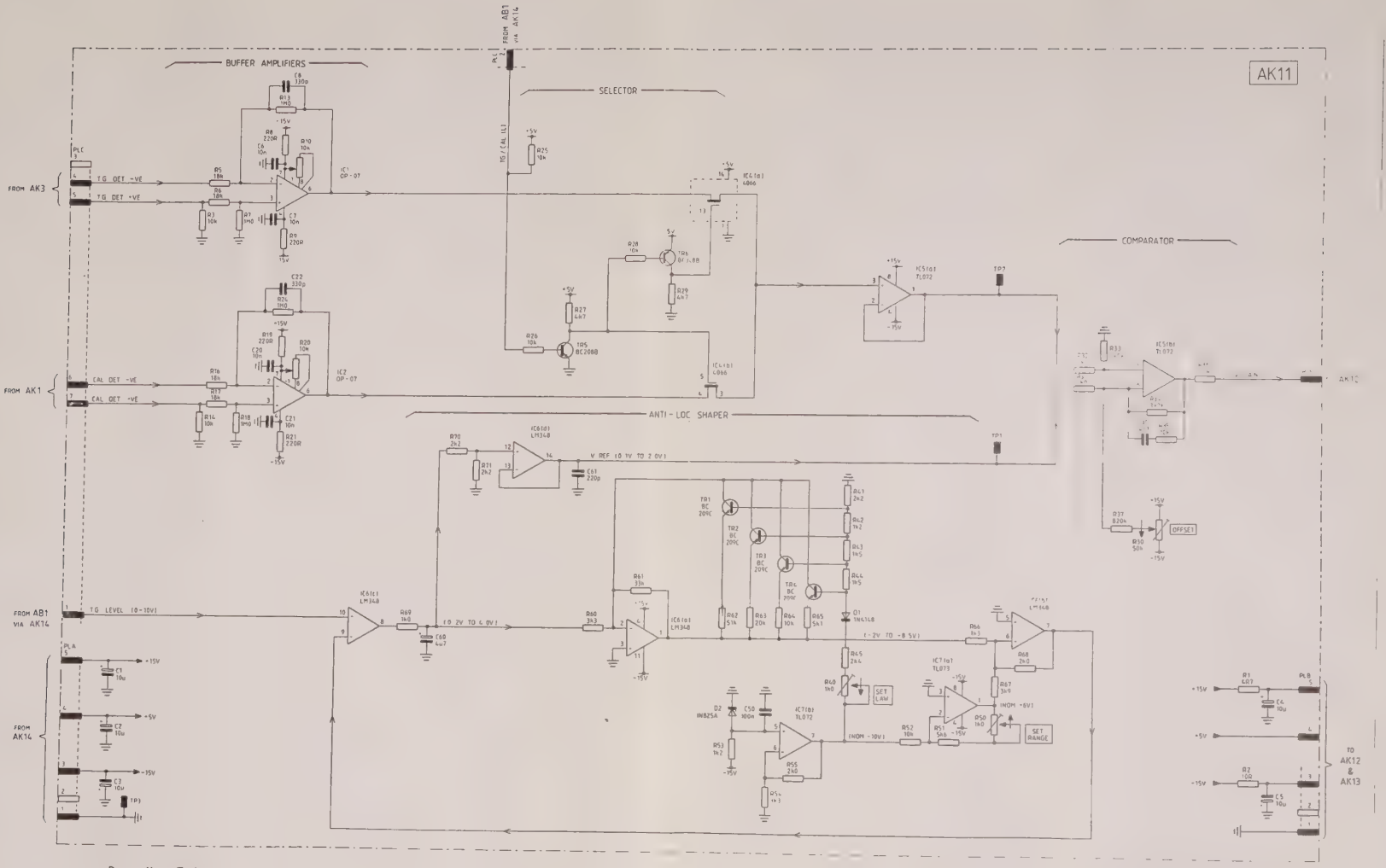



Drg. No. Z *****_****
Sht. 1 of 1, Iss. 1

Fig. 71

Sep. 87

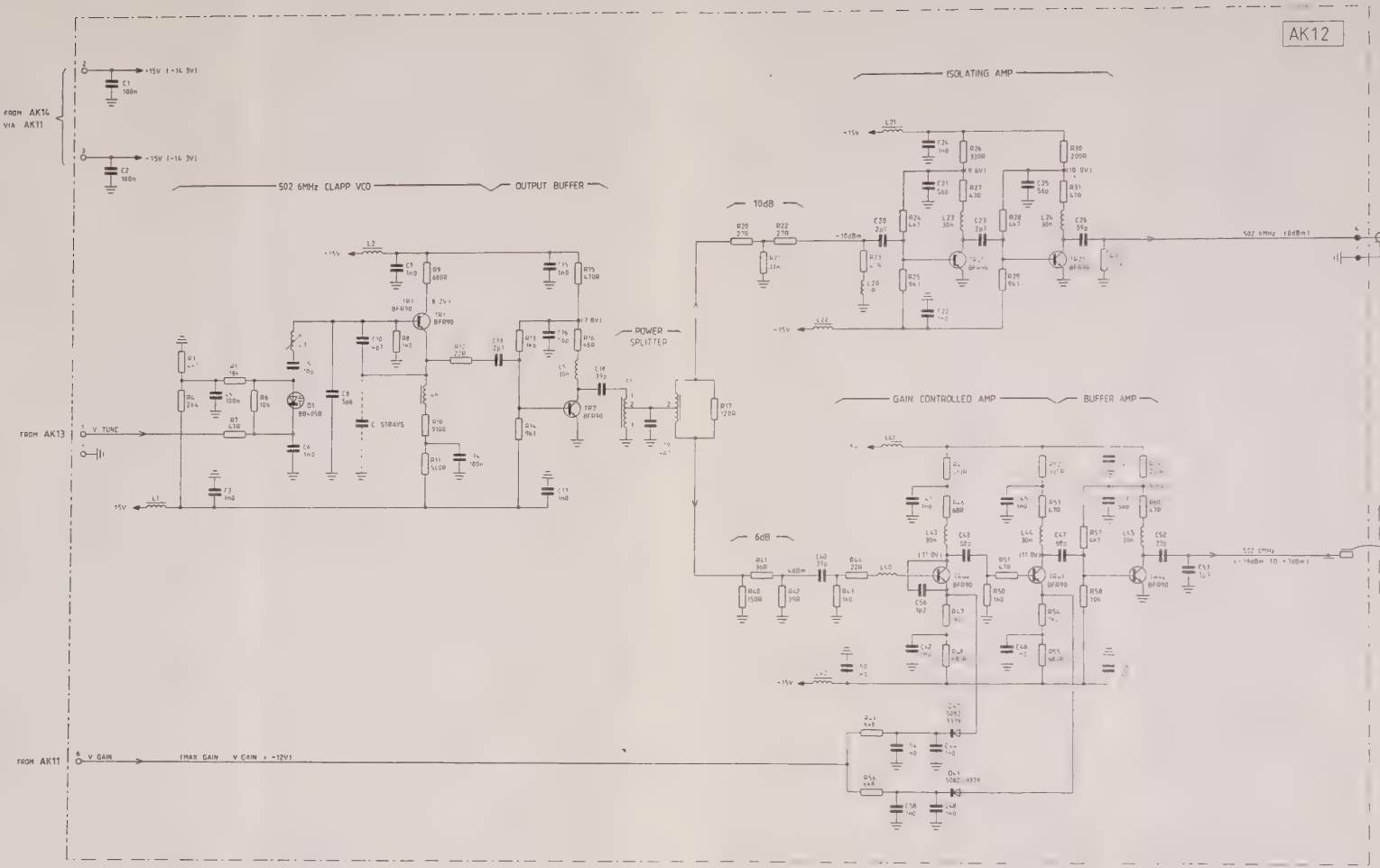
AK8 TG 2nd mixer




Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

Fig. 72

AK11 502.6 MHz levelling loop

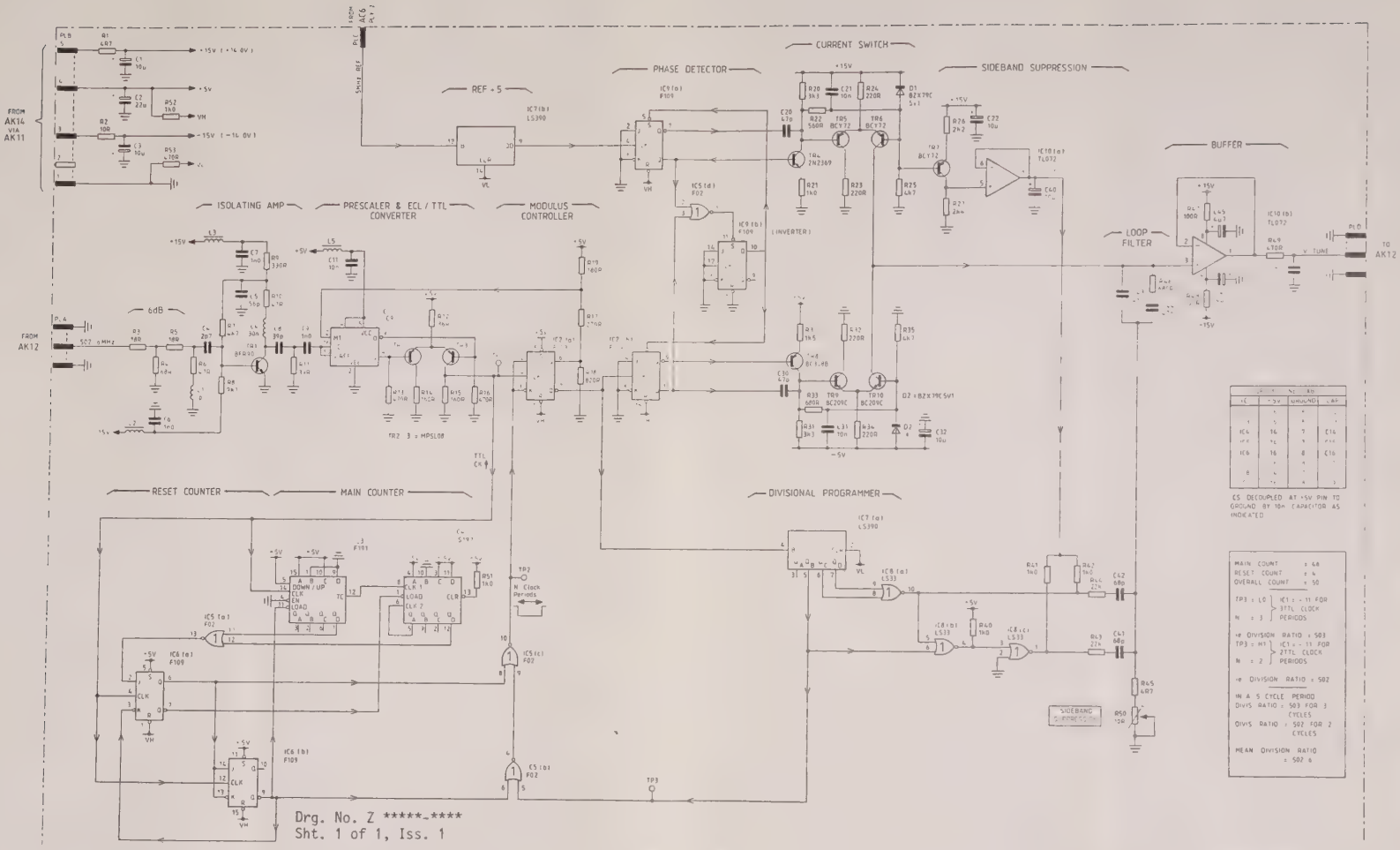



Drg. No. Z *****_****
Sht. 1 of 1, Iss. 1

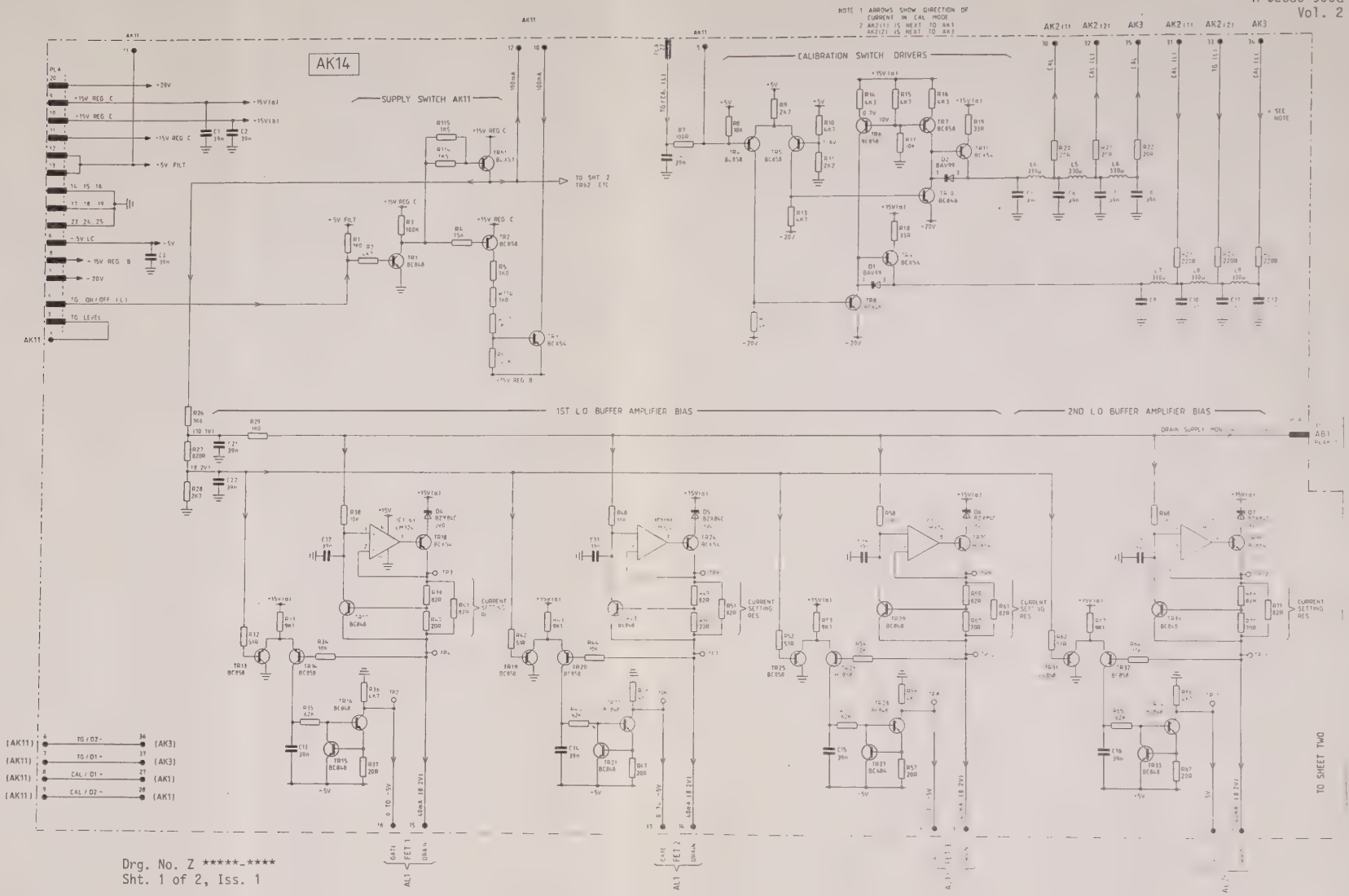
Fig. 73

Sep. 87

AK12 502.6 MHz v.c.o.

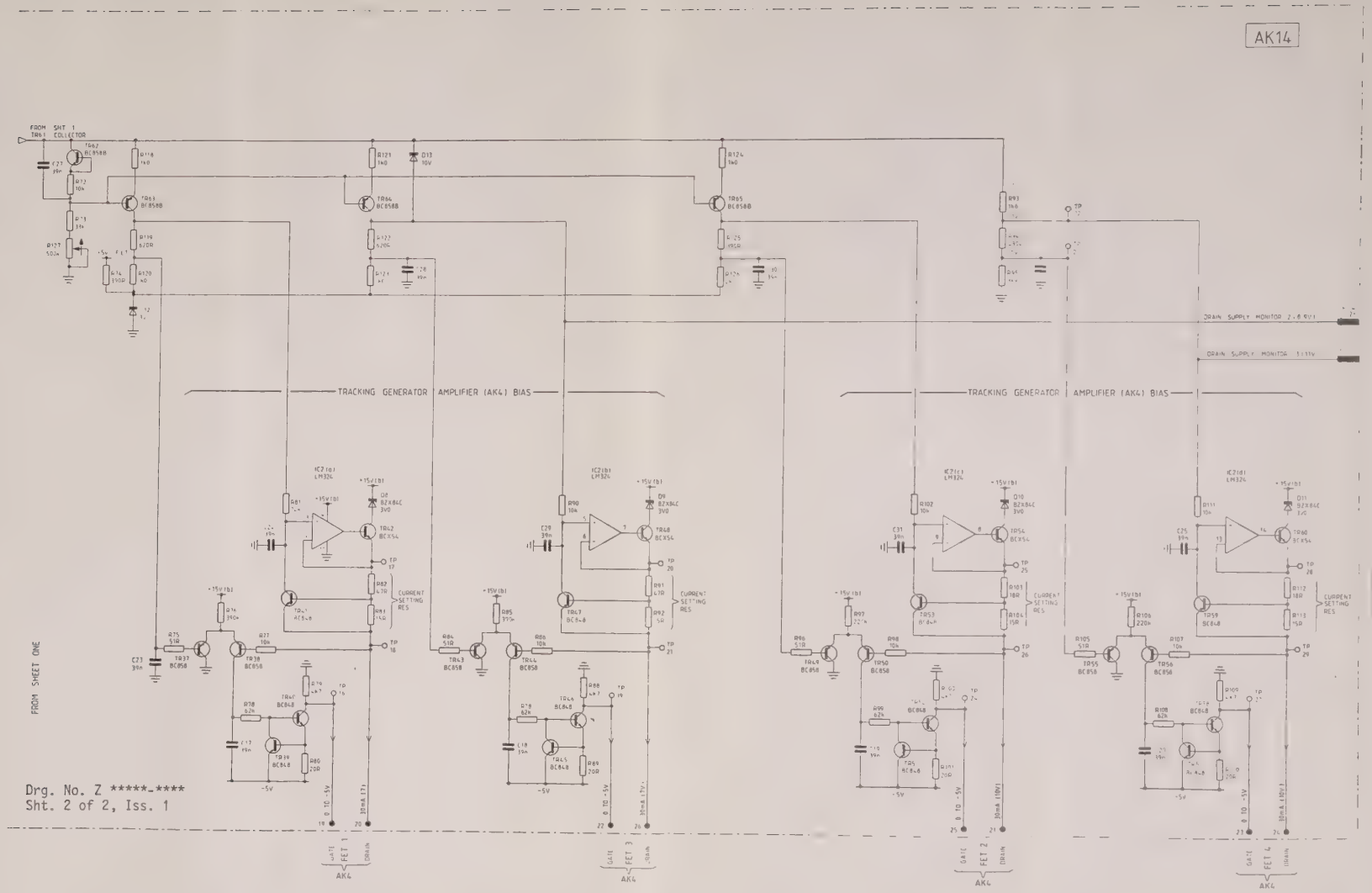



AK13 502.6 MHz phase detector

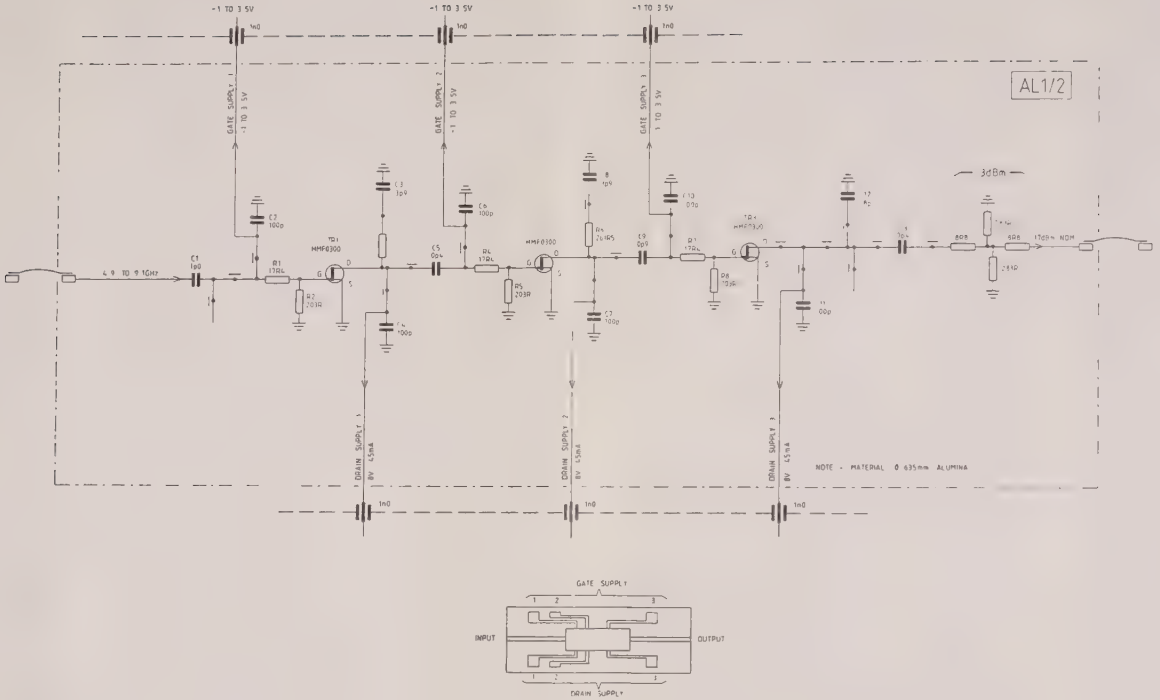



Drg. No. Z *****_****
Sht. 1 of 2, Iss. 1

AK14 TG supply distribution

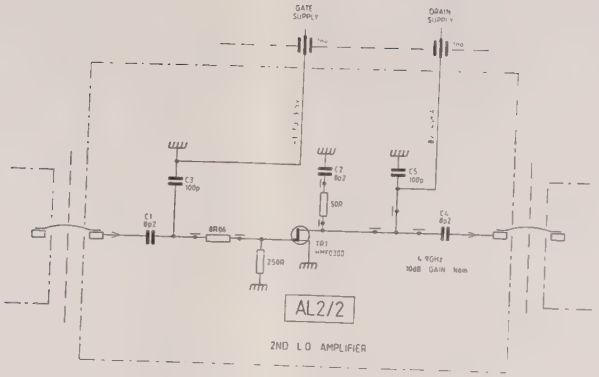



AK14 TG supply distribution

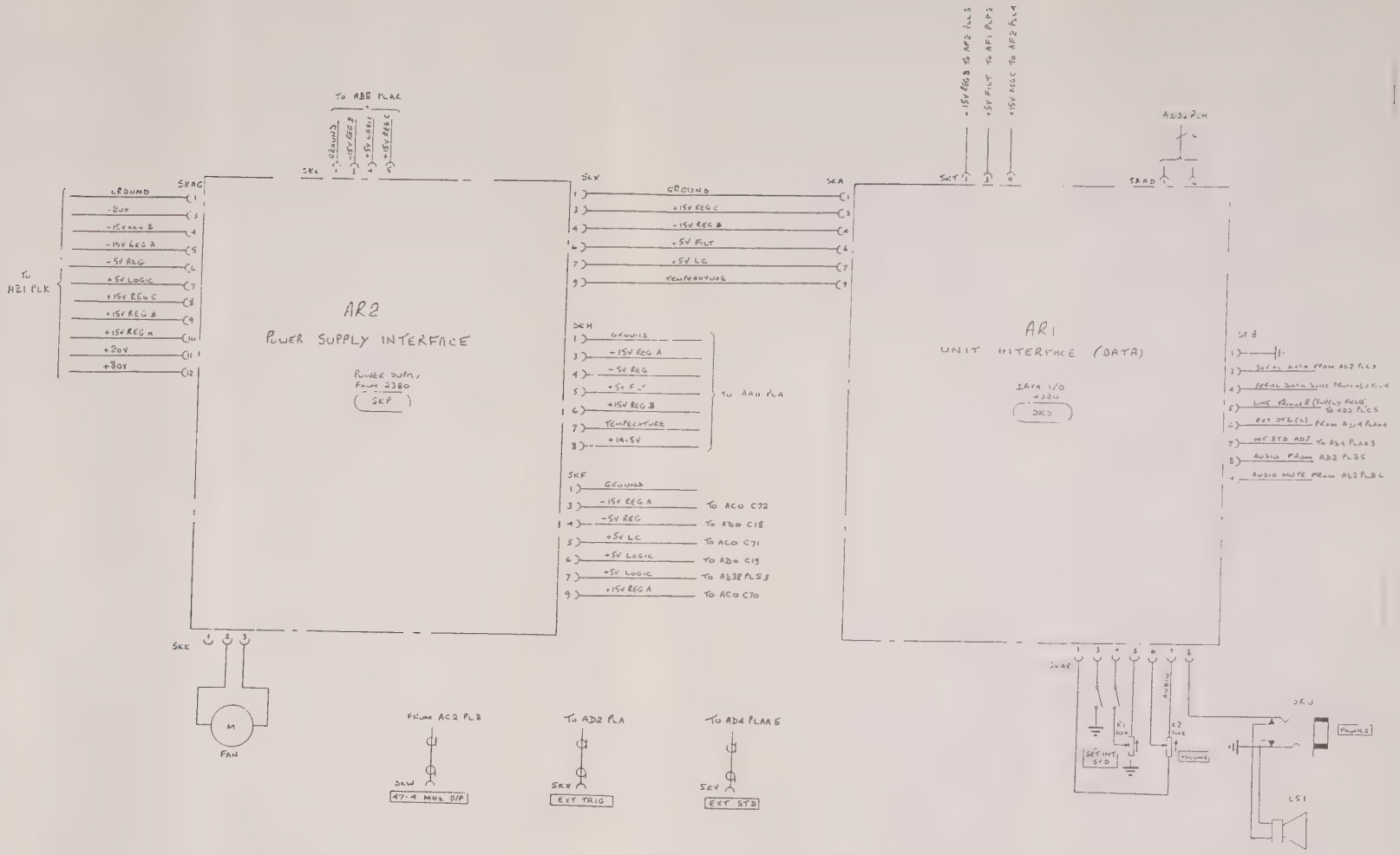



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

AL1/2 1st l.o. amplifier




Drg. No. Z *****_****
Sht. 1 of 1, Iss. 1




Drg. No. Z 44990-670M
Sht. 1 of 1, Iss. 1

Fig. 79

Sep. 87

ARO Rear panel interconnections

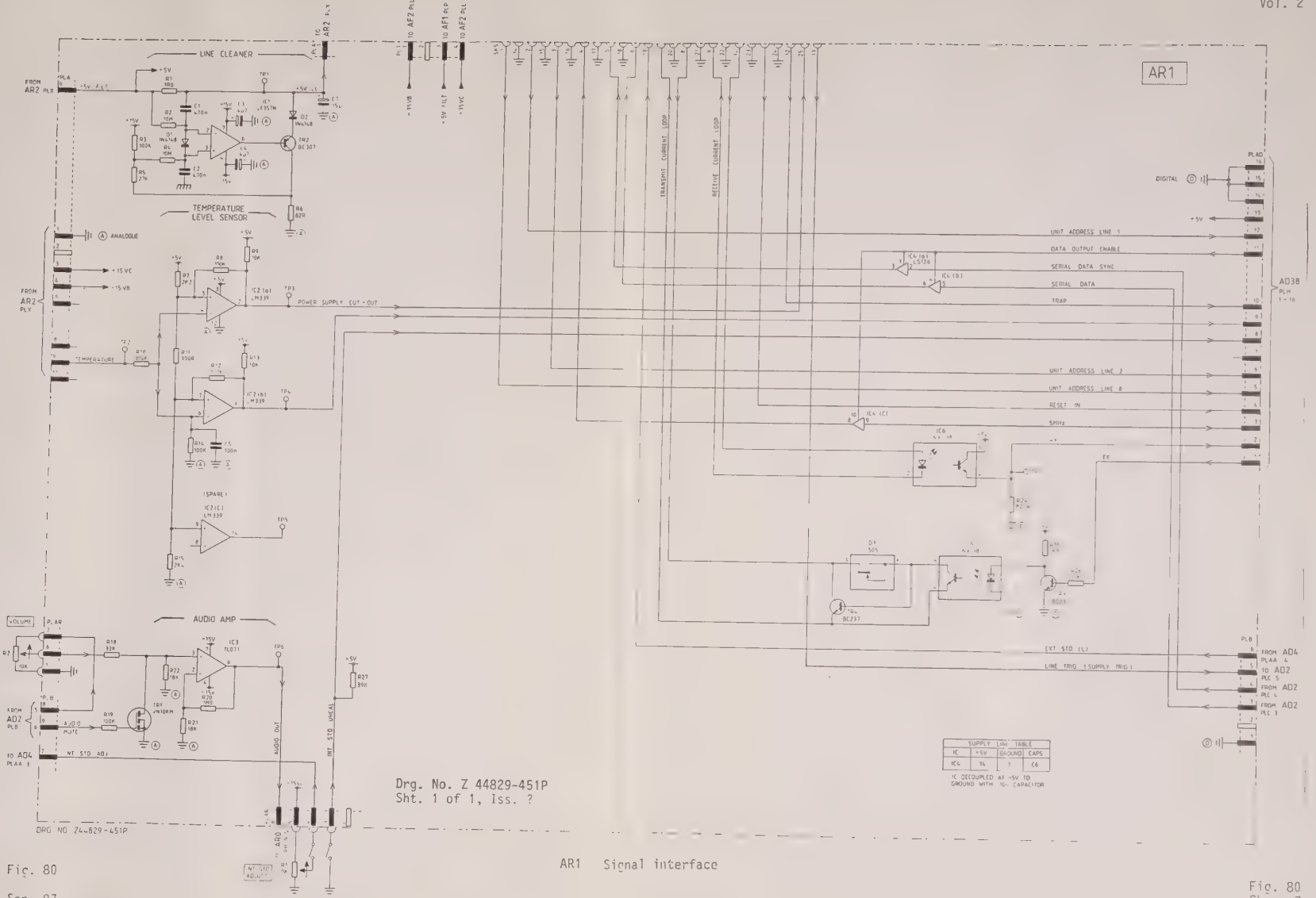



Fig. 80

AR1 Signal interface

Sep. 87

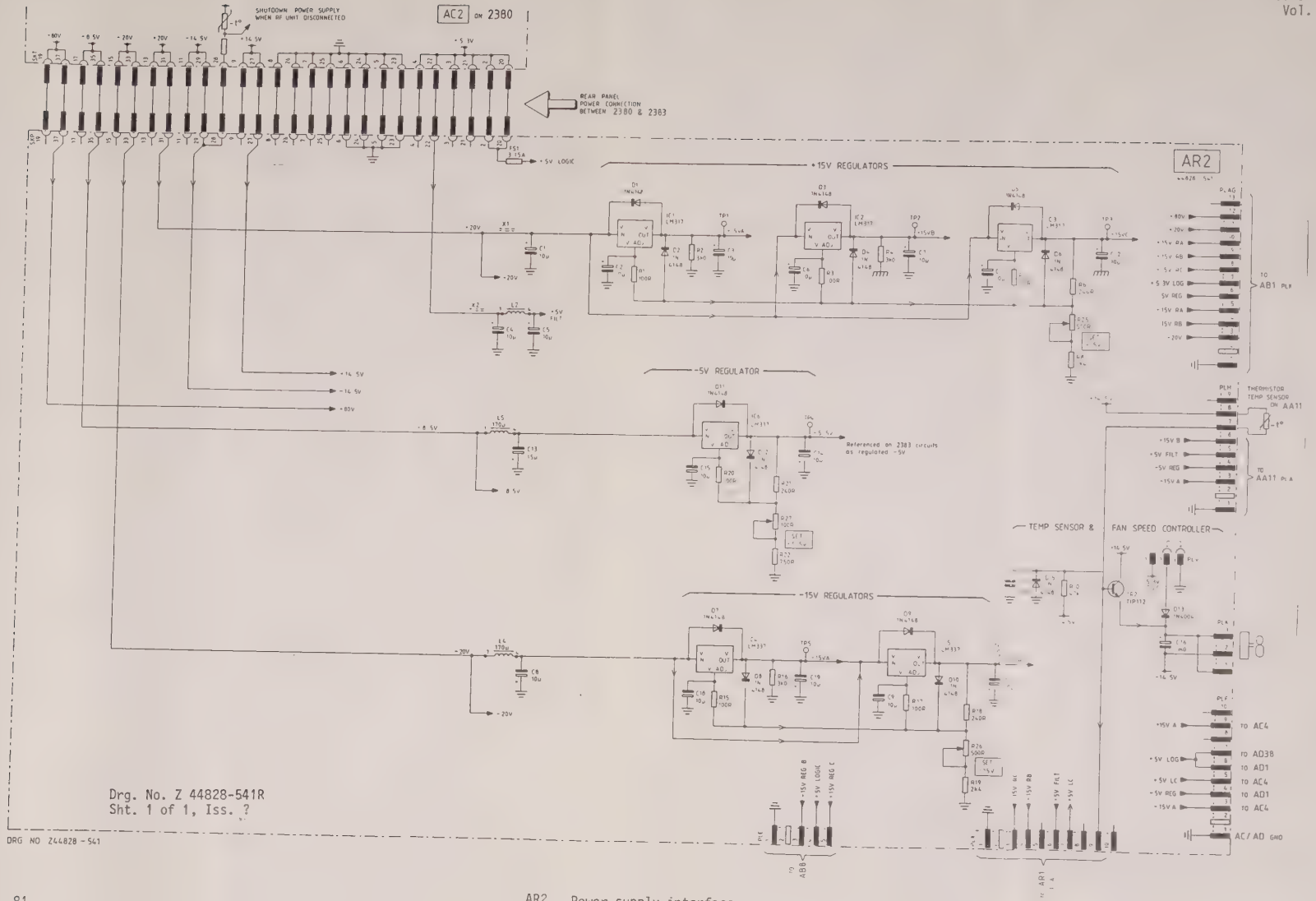
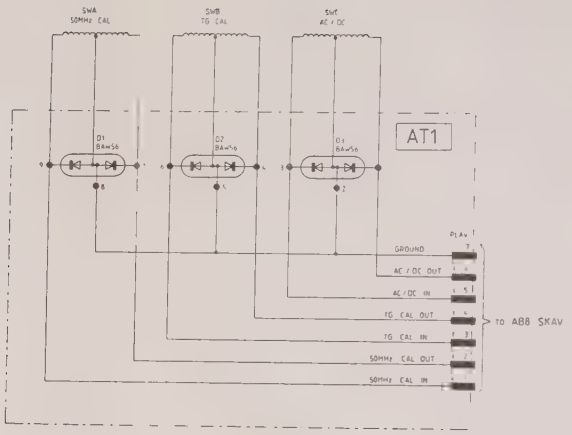



Fig. 81 AR2 Power supply interface

Sep. 87

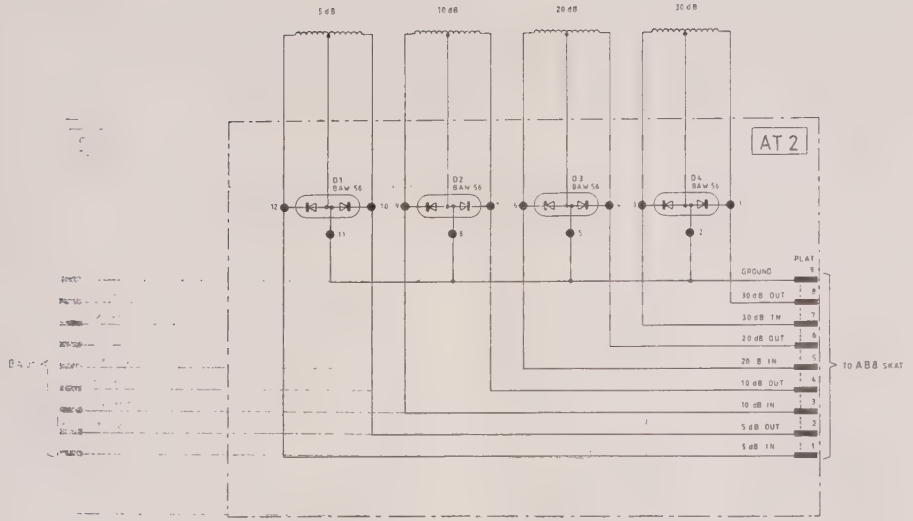



Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

Fig. 82

Sep. 87

AT1 Input switch p.c.b.




Drg. No. Z *****-****
Sht. 1 of 1, Iss. 1

AT2 4-section attenuator

MARCONI INSTRUMENTS LIMITED

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|---|---|
| SERVICE DIVISION | The Airport<br>LUTON<br>Bedfordshire LU2 9NS<br>Telephone: (0582) 33866<br>Telex: 825248 |
| HEAD OFFICE | Longacres<br>ST ALBANS<br>Hertfordshire AL4 0JN<br>Telephone: (0727) 59292<br>Telex: 23350<br>Fax: (0727) 57481(Gp.3) |
| FRANCE | MARCONI INSTRUMENTS<br>18 Rue du Plessis-Briard, Le Canal<br>Courcouronnes<br>91023 EVRY<br>Telephone: (16) 077 9066<br>Telex: 690482<br>Fax: (16) 077 6922 |
| GERMAN FEDERAL REPUBLIC | MARCONI MESSTECHNIK GmbH<br>Landsberger Strasse 65<br>Postfach 1929<br>8034 GERMERING<br>Telephone: (089) 84 9360<br>Telex: 5212642<br>Fax: (089) 84 19142(Gp.3) |
| SPAIN | MARCONI INSTRUMENTOS S.A.<br>General Yague 6 bis-5<br>28020 MADRID<br>Telephone: (1) 455 0391<br>Fax: (1) 455 1922 (Gp. 3) |
| USA | MARCONI INSTRUMENTS<br>3 Pearl Court<br>Allendale Park<br>ALLENDALE<br>New Jersey 07401<br>Telephone: (201) 934 9050<br>Telex: 6853077 MIUSA<br>Twx: (710) 991 9752<br>Fax: (201) 934 9229 |

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